

NUCLEAR SCIENCE ABSTRACTS

Vol. 7 No. 16, August 31, 1953

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September 9-12, 1953

CONFERENCE ON NUCLEAR ENGINEERING. Sponsored by: University of California, Berkeley, California.

Inquiries should be addressed to: Professor R. A. Fayram, 208 Mechanics Building, University of California, Berkeley 4, California.

October 29-30, 1953

CONFERENCE ON ATOMIC ENERGY, Waldorf-Astoria Hotel, New York. Sponsored by: National Industrial Conference Board.

Inquiries should be addressed to: R. Maxil Ballinger, Division of Business Practices, National Industrial Conference Board, 247 Park Avenue, New York 17, N. Y.

June 20-25, 1954

NUCLEAR ENERGY MEETING, University of Michigan, Ann Arbor, Michigan. Sponsored by: American Institute of Chemical Engineers.

Inquiries should be addressed to: Professor Donald Katz, University of Michigan, Department of Engineering, Ann Arbor, Michigan.

REPORTS REFERENCE LIST

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The abstract number for each report is listed at the upper right of the entry. If the number bears an asterisk, the report is title listed only and no abstract is included.

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| AECU-2579 | 4609 | DOGS. Roy E. McDonald, Ross E. Jensen, Herbert C. Urry, Vern S. Bolin, and Philip B. Price. [1951] 16p. (AECU-2587) |
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ADSORPTION OF BOTH COMPONENTS FROM BINARY
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AN ELECTRON BOMBARDMENT ION SOURCE FOR MASS
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EXTERNAL INDIVIDUAL ELECTRICAL CONNECTIONS
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ment Co.
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PHOTOMETRIC DETERMINATION OF URANIUM AS
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METHOD OF OUTLINING AN ORE BODY BY MAXIMUM
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PRIMARY SEDIMENTARY TREND INDICATORS AS
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POSSIBILITIES FOR URANIUM IN CERTAIN REGIONS OF
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- SO-2028 4596
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THERMODYNAMIC ACTIVITIES IN IRON-NICKEL ALLOYS.
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TABLE OF ISOTOPES. J. M. Hollander, I. Perlman, and
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THE COMPLEX ALPHA SPECTRA OF THE HEAVY ELE-
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ALTERNATING GRADIENT FOCUSING OF THE 20-INCH CYCLOTRON EXTERNAL BEAM. Edward L. Hubbard and Elmer L. Kelly. Apr. 23, 1953. 23p. (UCRL-2181)
- UCRL-2189 4622
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THE PHOTOMULTRON, A GAMMA RAY DETECTING INSTRUMENT FOR CONTROL PURPOSES. Hugh W. Maxwell. Mar. 7, 1951. 9p. (NEPA-1744)
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LIQUID METAL COOLANT HEAT EXCHANGERS: PROGRESS FOR MONTH ENDING MARCH 15, 1951. E. C. Koerper. Mar. 15, 1951. 6p. (NEPA-1782; ARL-HE-110)
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EXPLORATORY STUDIES ON PHARMACOLOGICAL PROPERTIES OF ORGAN EXTRACT. Melba A. Grafius. Feb. 27, 1953. 10p. (NM-000-018.07; Memo Report 53-3)
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[Institute for Mathematics and Mechanics, New York Univ.]
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- NP-4602(p. 1-61) 4541
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COLORADO AND EASTERN UTAH. Alice Dowse Weeks.
Feb. 1953. 22p. (TEI-285)
- USNRDL-395 4546
Naval Radiological Defense Lab.
ADDITIVITY OF RADIATION PROTECTION BY CYSTEINE
AND SODIUM NITRITE IN MICE. L. J. Cole and M. E.
Ellis. Apr. 3, 1953. 24p. (USNRDL-395)
- WADC-TR-52-16 4597
Armour Research Foundation
PHASE DIAGRAMS OF THE TITANIUM-ALUMINUM,
TITANIUM-CHROMIUM-IRON, AND TITANIUM-OXYGEN
ALLOY SYSTEMS. R. J. Van Thyne, E. S. Bumps, H. D.
Kessler, and M. Hansen. Dec. 1952. 86p. (WADC-TR-
52-16)
- WAL-401-143-3 4598
Barus Research Lab. of Physics, Brown Univ.
CORROSION AND PASSIVITY STUDIES WITH TITANIUM;
INTERIM TECHNICAL REPORT [FOR] JULY 1, 1952-
MAY 1, 1953. H. E. Farnsworth and A. M. Russell. May
1953. 58p. (WAL-401-143-3; Interim Technical Report 1)

BIOLOGY AND MEDICINE

4530

Columbia Univ.

EVOLUTION AS A CREATIVE PROCESS. Theodosius Dobzhansky. [1953] 20p. (AECU-2580)

Theories and concepts of evolution are reviewed. Microevolution, mesoevolution, and macroevolution are defined, and the role of each in the evolutionary process is discussed. Experimental analysis of the heterosis connected with chromosomal inversions in natural populations of *Drosophila* is suggested as a means for comparing microevolutionary and mesoevolutionary phenomena. (C.H.)

4531

Pennsylvania Univ. School of Medicine

STRUCTURE AND DIVISION OF THE BACTERIAL NUCLEUS. Edward D. DeLamater. [1953] 54p. (AECU-2583)

The author's concepts concerning the structure and divisional mechanisms of bacterial nuclei are discussed and observations upon which the conclusions are based are reviewed. 32 references. (C.H.)

4532

Pittsburgh Univ.

THERMAL INACTIVATION OF A BACTERIA-BACTERIOPHAGE SYSTEM. Anne Buzzell, David Trkula, and Max A. Lauffer. [1953] 14p. (AECU-2586)

The thermal inactivation rate at 47°C of the complex, *E. coli* B bacterium-T2r bacteriophage, is much higher than that of either free bacteria or free phage, and increases with time of incubation of the complex at 37°. The maximum rate of inactivation for the complex after 12 to 14 min was about 10-fold greater than that for the initial complex. Complexes developed for 14 min or more burst and release active phage particles immediately on heating at 47°. The number of free phage particles released by heating at 47° increased sharply with time of growth beyond 14 min. The yield of active phage obtained from this premature lysis was consistent with data in the literature on premature lysis effected by cyanide and 5-methyl tryptophan. (auth)

4533

Naval Medical Research Inst., Bethesda

EXPLORATORY STUDIES ON PHARMACOLOGICAL PROPERTIES OF ORGAN EXTRACT. Melba A. Grafius. Feb. 27, 1953. 10p. (NM-000-018.07; Memo Report 53-3)

In the course of studies concerned with the etiology of the acute radiation syndrome a pharmacological approach has been selected using extracts from organs of irradiated and non-irradiated animals. Bio-assay studies have been performed in order to test certain pharmacological actions of these extracts. Procedures used and some observations made in the course of these entirely exploratory investigations are presented. (auth)

4534

Radiation Lab., Univ. of Calif., Berkeley

EVIDENCE FOR LIPOLYTIC ACTION BY HUMAN PLASMA OBTAINED AFTER INTRAVENOUS ADMINISTRATION OF

HEPARIN. B. Shore, A. V. Nichols, and N. K. Freeman. May 5, 1953. 13p. (UCRL-2204)

Plasma from human subjects who have received intravenous heparin a short time previously, when incubated with certain lipoproteins for period of 4 to 8 hr at 37°C, has been found to cause partial hydrolysis of the glyceride component of the lipoprotein with concomitant release of fatty acids. Sera from the same individuals before heparin administration did not cause measurably real hydrolysis under the same conditions. Heating the plasma before incubation prevents the reaction, but of a number of common enzyme inhibitors tried, only Na arsenite is effective. Our results are consistent with, and may at least partially explain, certain other lipoprotein changes which may be classed as heparin effects, e.g., the observed redistribution of lipoproteins shown by the ultracentrifuge and the clearing of turbidity in egg lipoprotein solutions. (auth)

RADIATION EFFECTS

4535

Pittsburgh Univ. Graduate School of Public Health

MULTIPLICATION OF COXSACKIE VIRUS IN ADULT MICE EXPOSED TO ROENTGEN RADIATION. F. S. Cheever. [1953] 21p. (AECU-2584)

Swiss white mice weighing 10 to 12 g were exposed to whole-body x radiation 24 to 120 hr before the intraperitoneal inoculation of the Powers strain of Coxsackie virus. Non-irradiated control mice were injected with virus at the same time. At regular intervals thereafter mice from each group were sacrificed and the viral content of selected organs determined. In general, virus could be demonstrated over a longer period of time in the organs of the irradiated mice as compared to the controls, and with rare exceptions the former yielded a consistently higher viral titer. When the amount of x radiation was varied, higher concentrations of virus were demonstrated in the organs of mice receiving greater exposure. In contrast to these findings the increase in mortality rates among the irradiated mice was irregular and at best moderate. Irradiation of mice 48 hr after inoculation of the virus was not followed by a demonstrable increase in either virus yield or mortality rate as compared to non-irradiated control animals. (auth)

4536

Philadelphia General Hospital

INFRARED SPECTROSCOPY OF LIVER GLYCOGEN. STUDIES OF FETAL LIVER BEFORE AND AFTER X-RAY IRRADIATION. H. P. Schwarz, H. E. Riggs, C. Glick, J. McGrath, R. Childs, E. Bew, Jr., and F. Stone. [1953] 19p. (AECU-2585)

Frozen and dried section of adult and fetal liver were studied by infrared spectroscopy. The infrared absorption band found at 9.70 to 9.60 μ is definitely assigned to glycogen. Differences of location of this band in adult and fetal liver are discussed. A spectroscopic method for estimation of glycogen in liver sections is described, and glycogen content in adult and fetal liver under various nutritional conditions is reported. Studies of liver glycogen after x irradiation show the existence of an acute and delayed effect, the former decreasing and the latter increasing liver glycogen. (auth)

4537

Utah Univ. Coll. of Medicine

SOME EFFECTS OF ACUTE IRRADIATION INJURY IN DOGS. Roy E. McDonald, Ross E. Jensen, Herbert C. Urry, Vern S. Bolin, and Philip B. Price. [1951] 16p. (AECU-2587)

Observations are summarized which were made on over 100 dogs subjected to single mid-tissue doses of x radiation ranging from 450 to 550 r. Data are presented on fluid and electrolyte balance, the effects of irradiation upon the circulating red-cell mass, plasma volume, blood volume, and capillary permeability. It was concluded that, aside from destruction of radiosensitive tissues, altered hematopoiesis, and resultant fever and infection, the irradiated animals showed changes differing only in degree from those manifested by non-irradiated dogs with restricted food intake. It is suggested that principles of fluid and electrolyte therapy for irradiated dogs need not differ from those applicable to any anorectic animal. (C.H.)

4538

Naval Medical Research Inst., Bethesda

EFFECT OF X-IRRADIATION ON WEIGHT AND CONTENTS OF THE RAT STOMACH, SMALL INTESTINE AND CECUM-COLON. Robert A. Conard. Jan. 19, 1953. 11p. (NM-006-012.04.58)

The effect of 500-r whole-body irradiation on organ weights and weights of the contents of the stomach, small intestine, and cecum-colon of the rat was studied. All three components showed loss of weight during the first three- to four-day post-irradiation period which was greater than body weight loss. The stomach, small intestine, and cecum-colon showed percentage weight losses of 15.7, 34.4, and 23.6, respectively. Organ weights, except for the stomach, returned nearly to normal on the fourth and fifth day. The significantly greater weight loss in the small intestine was believed to reflect greater sensitivity of this part to ionizing radiation. It was pointed out that these weight changes were not due to dehydration or edema of the tissues or to the lowered food intake alone, but were in a large part due to specific effects of radiation. The stomach showed the greatest variation in contents after irradiation, with a marked increase occurring during the first 72 hr which was believed to be associated with delayed emptying of the stomach. During this same period the small intestine and cecum-colon showed slightly reduced contents which became liquid and foul-smelling in character. From the third to fourth days through the seventh day there was a marked increase in contents in all parts above the control range with a change to the normal semi-solid state. It was believed that this change was the reflection of compensatory increased food consumption associated with improved gastro-intestinal function. (auth)

4539

Naval Medical Research Inst., Bethesda

DEFECTS IN HEMOSTASIS PRODUCED BY WHOLE BODY IRRADIATION. E. P. Cronkite, Naval Medical Research Inst., Bethesda and George Brecher, National Inst. of Arthritis and Metabolic Diseases, National Institutes of Health. Dec. 31, 1952. 34p. (NM-006-012.05)

Modern concepts of factors which contribute to the bleeding state in the irradiated animal are summarized. Tabulated data are presented on the effects of various doses of radiation on percent mortality, survival time, blood clotting time, platelet count, prothrombin level and granulocyte count, and on the effects of treatment with antibiotics and platelet transfusions on the bleeding state. 48 references. (C.H.)

4540

Air Force Radiation Lab., Univ. of Chicago

QUARTERLY PROGRESS REPORT NO. 7. Apr. 15, 1953.

117p. (NP-4602)

Separate abstracts have been prepared on two sections of this report. (For preceding period see NP-4447.) (C.H.)

4541

Air Force Radiation Lab., Univ. of Chicago

[PHYSIOLOGICAL EFFECTS OF RADIATION.] p. 1-61 of QUARTERLY PROGRESS REPORT NO. 7. Apr. 15, 1953. 61p. (NP-4602(p. 1-61))

Increased adenosine triphosphatase and 5-nucleotidase activity of spleen and thymus glands of rats and mice following whole-body x irradiation was demonstrated, and the feasibility of using determinations of enzyme activity as a method of estimating radiation dosage biologically is discussed. In a study of the effects of central nervous system stimulants on survival time and weight loss of x-irradiated rats, four tetrazol derivatives related structurally to metrazol were tested. Those which possessed convulsant activity conferred protective effects, while those which caused sedative effects had no protective ability. The protective effect of pre-radiation injections of Na azide against radiation injury was confirmed for mice. Preliminary results in a study of the role of catalase formation on the effects produced by H_2O_2 formation in radiation injury are discussed. Previously observed species specificity of the catalase molecule, marked by the inability of one species to absorb in the tissues the injected catalase of another species, was confirmed and amplified. Injected hemin was found to offer no protection against radiation injuries in mice. Studies reported indicate that the initial level of carboxypeptidase inhibitor in the blood of rats bears no relation to the animal's length of survival after whole-body x irradiation. A low initial blood catalase may be associated with susceptibility to x irradiation, and weight loss following irradiation bears no relation to initial blood levels of carboxypeptidase inhibitor or catalase, or to length of survival. No evidence was obtained for the existence of a naturally-occurring, radiation-labile inhibitor of the 5-nucleotidase in mouse liver. (C.H.)

4542

Air Force Radiation Lab., Univ. of Chicago

[RADIATION EFFECTS.] p.62-114 of QUARTERLY PROGRESS REPORT NO. 7. Apr. 15, 1953. 53p. (NP-4602(p.62-114))

Doses of analgesic agents were determined which will approximately double the reaction time of rats and mice to heat stimuli. X irradiation of 250, 500, and 750 r had no effect on the response time of rats and mice, or on the analgesic effect of the drugs tested. Data are presented on the effect of fatty acid esters as solvents for para-aminopropiophenone on the survival of mice treated before exposure to 800 r total-body x irradiation. Data are given on the recovery in the rate of cell division of x-irradiated amoebae following the introduction of nonirradiated cell portions prepared from normal cells. Equations are presented for the determination of the efficiencies of gas absorbers, absorbents, and adsorbers. Anesthetization, either before or after irradiation, failed to decrease the 30-day mortality of rats, and no significant difference was observed in the weights or 30-day mortality in rats irradiated intermittently or continuously. The exposure of parental male and female mice to 200 r of x radiation influenced the frequency of pregnancies, induced sterility in the females, and reduced the litter sizes in some litters conceived after irradiation. A simple, rapid method for the estimation of catalase activity in blood samples by the amount of heat liberated is described. (C.H.)

4543

IRRADIATION SARCOMA. Arthur Jones. *Brit. J. Radiol.* 26, 273-84(1953) June.

A review has been made of clinical aspects of sarcoma

induced by external irradiation. The literature is surveyed, and two new cases are reported. One arose in an area of chronic radiodermatitis over the sacrum 7 years after million-volt x-ray therapy for papilloma of the bladder. The other, an osteogenic sarcoma, occurred in the mandible 7 years after deep x-ray therapy for facio-cervical actinomycosis. (auth)

4544

ALPHA-RAY DOSAGE IN BONE CONTAINING RADIUM. F. W. Spiers. *Brit. J. Radiol.* **26**, 296-301(1953) June.

Calculations are made of the dose rates to soft tissue structures within bone containing Ra and its decay products. The analysis is used to derive permissible Ra burdens and is further applied to some observations of Hoecker and Roope who measured Ra concentrations in bone samples by α -track autoradiography. It is shown that dose rates of 0.3 and 1.5 rem per week are delivered to osteocytes by Ra burdens of 0.02 and 0.1 μg uniformly distributed throughout the skeleton. The accepted maximum permissible Ra burden is considered in the light of the calculated dose rates to different structures in bone, and the value of the relative biological efficiency of α radiation is discussed in relation to carcinogenesis. (auth)

4545

INFLUENCE OF SEVERAL NUTRITIONAL FACTORS ON THE MORTALITY OF THE MOUSE DUE TO X RADIATION.

R. Paris and J. Vevasseur. *Thérapie* **8**, 57-61(1953). (In French)

Anomalies in the life span of rabbits subjected to equal doses of x radiation led to experiments on the dietary factors affecting the mortality of mice after irradiation. It was found that foods such as fodder beets, turnips, green cabbage, spinach, and carrots increased radiosensitivity whereas red beets, red cabbage, and lettuce decreased it. The influence of glucides, proteins, and lipids was also studied. Diets rich in glucides increased radiation sensitivity while glucose decreased this effect. Tests with several proteins showed these substances to increase radiation sensitivity. (K. S.)

RADIATION HAZARDS AND PROTECTION

4546

Naval Radiological Defense Lab.

ADDITIVITY OF RADIATION PROTECTION BY CYSTEINE AND SODIUM NITRITE IN MICE. L. J. Cole and M. E. Ellis. Apr. 3, 1953. 24p. (USNRDL-395)

Pretreatment of x-irradiated mice with cysteine plus Na nitrite was found to afford protection against mortality at supralethal radiation-dose levels at which no protection was afforded by cysteine or Na nitrite alone. The mortality of irradiated mice pretreated with Na nitrite plus ethanol was not significantly different from that of irradiated control groups. Blood methemoglobin studies on mice and rats treated with Na nitrite indicate that the level of methemoglobinemia is not the prime factor in radiation preprotection by Na nitrite. Possible interpretations of the experimental results presented are discussed. (C.H.)

4547

Carbide and Carbon Chemicals Co. (Y-12)

DECONTAMINATION: A LITERATURE SEARCH. Rosalie L. Curtis. May 19, 1953. 32p. (Y-964)

A compilation of 70 abstracts of unclassified reports on the removal of radioactive contaminants from various materials is presented. (J.E.D.)

RADIATION SICKNESS

4548

PROTECTION AGAINST X-RAYS AND THERAPY OF RADIATION SICKNESS WITH β -MERCAPTOETHYLAMINE.

Z. M. Bacq, G. Dechamps, P. Fischer, A. Herve, H. Le Bihan, J. Lecomte, M. Pirotte, and P. Rayet. *Science* **117**, 633-6(1953) June 5.

Experimental studies on the metabolism and the protective action of β -mercaptoethylamine against radiation injury are reviewed. Good results are reported following injection in 4 out of 11 cases of leukemia, and in cases of radiation sickness in cancerous patients treated with ionizing radiations. Possible mechanisms of action are discussed. (C. H.)

TRACER APPLICATIONS

4549

Lankenau Hospital Research Inst., Philadelphia

A STUDY OF GLUCOSE OXIDATION IN WHOLE TISSUE HOMOGENATES. Charles E. Wenner, Doris F. Dunn, and Sidney Weinhouse. Lankenau Hospital Research Inst., Philadelphia and Institute for Cancer Research, Philadelphia and Temple Univ. [1953] 35p. (AECU-2590)

Experimental procedures employed in a study of glucose oxidation in whole-tissue homogenates are described. The incorporation of radioactivity from C^{14} -labeled glucose into respiratory CO_2 was used to estimate the oxidation of glucose by homogenates of various tissues from rats and mice. Data are presented on some of the properties of the glucose and fructose oxidation systems in several normal and neoplastic tissues. (C.H.)

CHEMISTRY

4550

Los Alamos Scientific Lab.

THE SECOND ORDER ELIMINATION OF NITROUS ACID FROM SECONDARY NITRAMINES. Walter H. Jones. [1953] 3p. (AECU-2581; LADC-1408)

If the loss of HNO_2 from secondary nitramines under the influence of alkalis is analogous to other second-order eliminations, such as the alkaline decomposition of p-toluenesulfonbenzylmethylamide, the results of orientation experiments can all be interpreted by the Hoffmann rule. However, as the size of the nitro group seems to lessen the effects of steric factors, it appears reasonable to assume a Saytzeff orientation. (J.S.R.)

4551

Michigan Univ.

EFFECT OF CHAIN BRANCHING ON ELECTROCHEMICAL CARBON-HALOGEN BOND FISSION. POSSIBLE MECHANISM FOR THE PROCESS. Philip J. Elving, Joseph M. Markowitz, and Isadore Rosenthal. Michigan Univ. and Pennsylvania State Coll. Apr. 1, 1953. 30p. (COO-120; Report 3)

In order to establish a better basis for correlating chemical reactivity with polarographic behavior of C-halogen bonds, an attempt has been made to ascertain whether the electrochemical process involves an elimination or free radical mechanism. The present study presents evidence derivable from structural influences. A group of branched-chain α -bromoalkanoic acids with several of their ethyl esters and straight-chain isomers were investigated polarographically. The relation between half-wave potential, $E_{1/2}$, and pH for the acids follows an S-shaped pattern having pH-invariant regions in the alkaline and acidic ranges, $E_{1/2}$ in the latter region being considerably more negative. The $E_{1/2}$ values for the esters are pH-independent, being slightly more positive than those of the corresponding acids in the acidic region. The polarographic waves all involve a

two-electron reduction process, and are all diffusion-controlled. In the acidic region, the branched-chain acids are more easily reducible than their straight-chain isomers by 0.20 to 0.13 v, the larger differences being observed for the lower molecular weight acids. In the alkaline region the situation is similar, but there are some apparent anomalies. The possible course of the electrode reaction is considered in the light of the influence of pH, of chain length, and of chain branching. Certain aspects of a possible analysis of the pH dependence are discussed and shortcomings of previous theoretical treatments are noted. Tentative hypotheses for a plausible reaction mechanism are advanced in terms of contemporary organic reactivity theory and steric concepts. Evidence is examined for an elimination process of either S_N1 or S_N2 pattern for the C-halogen bond fission, and some consideration is given to the possibility of a free-radical mechanism. The anomalous behavior in the alkaline region is explained as the result of formation of certain ring structures which can achieve stability only in the acids which behave anomalously. (auth)

4552

Michigan Univ.
ELECTROCHEMICAL FISSION OF CARBON-HALOGEN BONDS. Philip J. Elving. May 11, 1953. 8p. (COO-121; Report 4)

The available data on the electrochemical fission of C-halogen bonds, as obtained by polarographic and coulometric technics, are summarized, including the effects of structure and of substituent groups on the ease of bond fission as reflected in the half-wave potential values. The basis for consideration of the experimental data consists of two premises: electrons are considered the essential reagent and the electron transfer process is considered the essential chemical reaction. The observed behavior is then discussed from several viewpoints, e.g., the prediction of ease of bond fission on the basis of permanent polarization effects, and the compatibility of observed behavior on substitution with that predicted for different mechanisms, i.e., S_N1 , S_N2 , S_Ni and free radical processes; the reason for not considering the S_E process is given; a concerted termolecular mechanism process is considered. The usual factors are considered to be operative: (a) the electrophilic nature of the C atom to which the halogen is attached, and (b) the electron density around this C as it affects the bond strength of the C-halogen link. A number of specific applications are indicated which have been made or could readily be made of the studies described of electrochemical C-halogen bond fission. (auth)

4553

Massachusetts Inst. of Tech.
BOILING HEAT TRANSFER PROJECT PROGRESS REPORT FOR MARCH AND APRIL 1953. George Henry, Milton Raymond, Peter Griffith, and Joseph B. Walsh. 12p. (NP-4588)

The exchange capacity of resins in a mixed-resin bed in a high-temperature loop is reported. Crud deposition in a Westinghouse pump and in a Haywood-Taylor pump is discussed. (For preceding period see NP-4501.) (L.T.W.)

4554

Pennsylvania State Coll.
A THERMODYNAMIC STUDY OF SOME METAL AMINE COORDINATION COMPOUNDS (thesis). Glenn H. McIntyre, Jr. June 1, 1953. 110p. (NP-4591)

Because of a lack of data on the temperature effect on the formation constants for coordination compounds, and because almost all of the formation constants previously reported have been concentration constants, an investigation was initiated to determine activity formation constants

over a temperature range. From such activity constants, the thermodynamic quantities—free energy change, enthalpy change, and entropy change—occurring for the step-wise coordination reactions could be obtained. The experimental procedure developed to determine these formation constants involved the use of sufficiently dilute solutions that activity coefficients could be calculated using the Debye-Hückel equation. The method of calculating the formation constants involved the use of the same number of simultaneous equations as there are constants desired. The general equation used is based on Bjerrum's basic equation but does not include the approximations he was forced to make in order to have his final equation fit the general case. Formation constants and thermodynamic quantities are reported for the reaction of nickel(II) ion with ethylenediamine (en) and N-methyl-ethylenediamine (Meen); copper(II) ion with en, Meen, diethylenetriamine (dien), methyl-2-aminoethylsulfide, and 1,8-diamino-3,6-dithiaoctane; and zinc(II) ion with en, Meen, and dien. Proton amine formation constants and ΔH values are also reported for the amines studied. All reactions were studied at 0°, 10°, 20°, 30°, 40°, and 50°. (auth)

4555

Stanford Research Inst.
DETERMINATION OF THE MECHANISM OF THE INCREASE OF VISCOSITY OF ORGANOSILICON COMPOUNDS AT HIGH TEMPERATURES: QUARTERLY PROGRESS REPORT FOR DECEMBER 23, 1952 TO MARCH 23, 1953. Oliver F. Senn and A. P. Brady. Mar. 23, 1953. 14p. (NP-4592; Report 11)

Hydrolysis rates at 200°F in dioxane have been determined for tetraphenoxysilane (I), tetra-2-ethylhexoxysilane (II), and tetra-1-pentoxysilane (III). Pyrolysis rates for I and II were relatively slow in N. Degradation of I and II in an O bomb at 260°C was rapid, primarily because of hydrolysis. In a flow system, decomposition was not as extensive, probably because of removal of water formed. (auth)

4556

Radiation Lab., Univ. of Calif., Berkeley
THERMODYNAMIC FUNCTIONS FOR SPECIES IN LIQUID AMMONIA. William L. Jolly. May 1953. 23p. (UCRL-2201)

The heats and free energies of formation and entropies for various species in liquid NH_3 at 25°C have been calculated from data in the literature. The detailed calculations, as well as a table of potentials, are presented. (auth)

4557

SUBSTITUTED METHANES. XIV. VIBRATIONAL SPECTRA, POTENTIAL CONSTANTS, AND CALCULATED THERMODYNAMIC PROPERTIES OF BROMOCHLOROMETHANE. Alfons Weber, Arnold G. Meister, and Forrest F. Cleveland. J. Chem. Phys. 21, 930-3(1953) May.

Raman displacements, semiquantitative relative intensities, quantitative depolarization factors, and wave numbers for the infrared bands in the region 400 to 3000 cm^{-1} have been obtained for CH_2BrCl . A reasonable set of potential constants has been determined using Wilson's FG matrix method. The thermodynamic properties (heat content, free energy, entropy, and heat capacity) have been calculated from the spectroscopic and molecular structure data for 11 temperatures from 100 to 1000°K. (auth)

4558

SUBSTITUTED METHANES. XI. POTENTIAL CONSTANTS FOR CBr_3Cl . Arnold G. Meister and Fred L. Voelz. J. Chem. Phys. 21, 158(1953) Jan.

A new set of potential constants has been obtained for CBr_3Cl using the Wilson FG matrix method and a potential-energy function containing all possible second degree terms.

These constants are in better agreement with those determined for CBr_2Cl_2 , CBr_2ClH , CBr_2ClD , and CCl_3Br than the set given previously. (auth)

ANALYTICAL PROCEDURES

4559

Atomic Energy Project, Univ. of Rochester
MODIFIED PROCEDURE FOR ANALYSIS OF POLONIUM²¹⁰
IN BIOLOGICAL MATERIALS. Robert G. Scott and J. N. Stannard. Mar. 31, 1953. 22p. (UR-235)

A method of wet oxidation of animal tissues by HNO_3 is described. Results obtained when this is applied to tissues containing Po^{210} are compared to a previously used perchloric acid-nitric acid method. Preliminary work on a dry-ashing procedure is presented, and related problems such as decontamination of equipment are discussed. (auth)

4560

ULTRAVIOLET SPECTROPHOTOMETRIC DETERMINATION OF CERIUM. George Telep and D. F. Boltz. *Anal. Chem.* 25, 971-3(1953) June.

A sample of the material containing an amount of cerous ions such that the final solution contains not more than 0.10 mg/ml of Ce is acidified with HCl. K_2CO_3 and HCl are added until the pH of the resulting solution is between 10.1 and 10.5. H_2O_2 is added, and the absorbency of the solution is measured at 304 m μ in 1-cm silica cells. (L.T.W.)

4561

GAS TITRATIONS. Sidney Katz and John T. Barr. *Anal. Chem.* 25, 619-4(1953) Apr.

An instrument for direct gas-with-gas titrations, using pressure measurements to determine titer and end point, has been developed to take advantage of the reactivity of many halogen-bearing gases. The precision of such titrations has been determined to be better than 3% of the whole at the 95% confidence interval in the reaction of NH_3 and HCl. The reactions of Cl, ClF, ClF₃, and F with several gaseous hydrocarbons were studied for possible analytical applications. F, Cl-F mixtures, ClF-F mixtures, ClF₃-F mixtures, methane-ethane mixtures, and olefins in hydrocarbon mixtures were determined with precisions similar to that noted for the NH_3 -HCl titrations. Gas-with-gas titrations are a rapid means of determining reactive gases and of investigating gas reaction mechanisms. (auth)

4562

ANALYTICAL CHEMISTRY OF NIOBIUM AND TANTALUM. F. C. Palilla, Norman Adler, and C. F. Hiskey. *Anal. Chem.* 25, 926-31(1953) June.

The peroxy complexes of group IV, V, VI, and VII transition elements, formed in concentrated sulfuric acid media, were investigated for application to the analysis of niobia and tantalum mixtures. (A number of correlations were made of the spectra of the peroxy complexes with their positions in the periodic table.) One result of this study was the discovery of a peroxy-tantalate whose absorption spectrum had its peak at 285 m μ . Since the peroxy-niobate formed under identical conditions had its peak at 365 m μ , it was possible to develop a method for the simultaneous determination of niobia and tantalum (mixtures). This method has a precision of about 0.5% and is independent of the Nb-Ta ratio. This is the most precise method thus far developed for the analysis of these earth oxide mixtures. (auth)

4563

FLUOROMETRIC DETERMINATION OF SMALL AMOUNTS OF FLUORIDE. W. Allan Powell and J. H. Saylor. *Anal. Chem.* 25, 960-4(1953) June.

This work was initiated in an effort to obtain a better method for the determination of microgram quantities of fluoride. The methods finally developed depend upon the fact that the intensity of fluorescence of the compounds

formed on reaction of Al chloride with the dihydroxyazo dyes, Eriochrome Red B and Superchrome Garnet Y, is decreased on addition of fluoride. The methods were tested by analyzing solutions of pure NaF (0.2 to 100 micrograms of fluoride) both before and after a Willard-Winter distillation. The precision obtained is good and ions which are often present after distillation, such as sulfate and phosphate, do not interfere seriously. (auth)

ATOMIC WEIGHTS AND PERIODIC SYSTEMS

4564

ELEMENT-ANALOGS IN THE PERIODIC SYSTEM. E. P. Ozhigov. *Zhur. Obschei Khim.* 23, 177-80(1953) February. (In Russian) (cf. NSA 6-4564)

The system of grouping isotopes to illustrate nuclear periodicity and to combine the nuclear and chemical properties of elements is extended. On the basis of this system a comparison is made of the lanthanide and actinide elements. A study of the lanthanide analogs permits a prediction of type of radiation of the isotopes of Bk and Cf. (J.S.R.)

FLUORINE AND FLUORINE COMPOUNDS

4565

SUBSTITUTED METHANES. X. INFRARED SPECTRAL DATA, ASSIGNMENTS, POTENTIAL CONSTANTS, AND CALCULATED THERMODYNAMIC PROPERTIES FOR CF_3Br AND CF_3I , Paul R. McGee, Forrest F. Cleveland, Arnold G. Meister, Charlotte E. Decker, and Sidney I. Miller. *J. Chem. Phys.* 21, 242-6(1953) Feb.

Infrared wave numbers, relative intensities, and percent transmission curves have been obtained for CF_3Br and CF_3I in the region 400 to 2200 cm^{-1} . Assignments are given for the observed bands, in which the assignments of Plyler and Acquista for ν_2 and ν_3 are interchanged. Potential constants were calculated for both molecules by the Wilson FG matrix method. And, finally, the heat content, free energy, entropy, and heat capacity for the ideal gaseous state at 1 atm. pressure were calculated for 12 temperatures from 100 to 1000°K, using a rigid rotator, harmonic oscillator approximation. (auth)

LABORATORIES AND EQUIPMENT

4566

Oak Ridge National Lab.
DISCONNECTS AND INSTRUMENTATION FOR RADIO-CHEMICAL PROCESSING. Richard Stephenson. [1953] 10p. (CF-53-3-136)

4567

Boeing Airplane Co.
DERIVATION AND CONSTRUCTION OF A FINNED CIRCULAR TUBE CONDENSER GRID. Daniel W. Gunnarson. Aug. 7, 1952. 12p. (D-13265)

A condenser grid for a specific core geometry is presented together with derivations to show the method and assumptions used in its preparation. This grid, which is a correlation of the heat-transfer and pressure-drop data, provides a fast and easy method for obtaining the temperature rise and the total-pressure ratio of the air passing through the condenser at various airflows and condenser thicknesses. (auth)

4568

Carbide and Carbon Chemicals Co. (K-25)
EXTERNAL INDIVIDUAL ELECTRICAL CONNECTIONS FOR FLUORINE GENERATOR ANODES. J. J. Finley. Issued June 19, 1953. 13p. (K-1022)

The relation between the design features and the malfunctions of modified Hooker F generators is presented with a list of possible remedial design changes. One design change,

an external anode contact and support, has been developed which increases the anode flexibility and cooling, prevents the destructive corrosion of this mechanism, and reduces the costs of the anode assembly. (auth)

RADIATION EFFECTS

4569

Research Foundation, Washington Univ., Clayton, Mo.
THE EFFECT OF CHARGED PARTICLES ON THE
PHYSICO-MECHANICAL PROPERTIES OF MATERIALS;
MONTHLY REPORT COVERING THE PERIOD SEPTEMBER 15, 1950 TO OCTOBER 15, 1950. W. P. Armstrong.
7p. (NEPA-1598; NEPA-IY-9)

4570

BETATRON IRRADIATION OF AQUEOUS FERROUS SULPHATE SOLUTIONS. R. W. Hummel and J.W.T. Spinks.
Can. J. Chem. 31, 250-61(1953) Mar.

The oxidation of aerated aqueous solutions of ferrous ammonium sulfate has been studied using Ra γ rays and x rays of 24.5-Mev peak energy from a betatron. The behavior at high photon energies has been shown to be closely similar to that at lower photon energies. (auth)

4571

EFFECTS OF ATOMIC RADIATION ON POLYMERS.
Leo A. Wall and M. Magat. *Modern Plastics* 30, No. 11, 111-12, 114, 116, 176, 178(1953) July.

The effects on solid polymers of exposure to atomic pile radiation and the degradation of solutions by exposure to γ rays from Ra were studied by the use of viscosity methods. In the former case variation of the structure of the polymer was shown to cause both increases and decreases of molecular weight. It was demonstrated that, depending on the type of polymer, the measured intrinsic viscosity can be varied by the use of inhibitor-containing solvents in carrying out the measurement. This is taken to be evidence for immobilized free radicals within the solid polymer after exposure. When solutions of polymers were exposed to γ rays, O_2 was found to be necessary for degradation. In this case an aftereffect has been observed which is eliminated by the presence of inhibitor during the period of irradiation. The degradation appears to be a function of the square root of the number of radicals produced from the effects of γ rays on the solvents used. (auth)

4572

BETATRON IRRADIATION OF WATER SATURATED WITH BENZENE. G. R. Freeman, A. B. Van Cleavé, and J. W. T. Spinks. *Can. J. Chem.* 31, 448-56(1953) Apr.

The oxidation of benzene to phenol in dilute aqueous solution by Co^{60} γ rays and betatron x rays (23 Mev peak energy) is compared with the oxidation of Fe^{++} to Fe^{+3} under similar conditions. The ratio yield of phenol/yield of Fe^{++} oxidized was the same for Co^{60} and betatron radiations. The yield for the Co^{60} radiations was about 10% greater than the apparent yield for the betatron radiations, the difference probably being attributable to dose determination at high energies (>1 Mev). It is concluded that both reactions are independent of energy and dose rate over the ranges investigated. (auth)

SEPARATION PROCEDURES

4573

Atomic Energy Research Establishment, Harwell, Berks (England)
LIQUID-LIQUID EXTRACTION. PART 6. INDIVIDUAL FILM COEFFICIENTS ON AN AREA BASIS FOR A PACKED COLUMN. R. Gayler and H. R. C. Pratt. Mar. 2, 1953. 38p. (AERE-CE/R-905)

Individual film mass-transfer coefficients have been determined for the system ethyl acetate-water by the method of Colburn and Welsh, using a 4-in.-diam. column packed with $\frac{1}{2}$ -in. Raschig rings. Varying heights of packing from 6 in. to 3.0 ft were used, and the results are cross-plotted against height in order to eliminate entrance effects. Simultaneous determinations of holdup were also carried out in order to calculate the resulting mass-transfer coefficients on an area basis using the method proposed in an earlier paper. The results indicate that both mass-transfer coefficients are substantially unaffected by the flow rate of the continuous phase. The effect of varying dispersed phase velocity was also comparatively small, except at the lower flow rates where both coefficients increase sharply. Some evidence was obtained that the mass transfer in liquid-liquid systems of this type takes place by eddy and not by molecular diffusion, but this requires further confirmation. The reason for the variance of the mass transfer coefficients at low dispersed phase flow rates is discussed, and a tentative proposal is put forward for a general method of correlation of individual area mass-transfer coefficients. (auth)

4574

Yale Univ.
CHLORINE ISOTOPE SEPARATION BY THERMAL DIFFUSION. A. Z. Kranz and W. W. Watson. [June 4, 1953] 15p. (NYO-3025)

From "two-bulb experiments" the thermal diffusion constant α of HCl has been determined to be +0.010 at $T_r = 685^\circ K$ and -0.009 at $T_r = 229^\circ K$. Such a rapid change of α and R_T with temperature and an inversion temperature at or above room temperatures seem to be characteristic of strongly polar molecules. The troublesome "memory effects" of HCl in a mass spectrometer can be eliminated by using a pin-hole leak right in the box of the ion source plus a baking out, flushing and repeated-analysis routine. Some details are given of a 6.8-m hot-wire thermal diffusion column apparatus, having an equilibrium separation factor of 7, and which has provided fairly large samples of HCl enriched to 94% HCl^{35} and 62% HCl^{37} for cyclotron beam targets and other experiments. (auth)

SORPTION PHENOMENA

4575

Ames Lab.
ADSORPTION OF BOTH COMPONENTS FROM BINARY SOLUTION ON POROUS ADSORBENTS. Robert D. Hansen and Robert S. Hansen. Apr. 20, 1953. 11p. (ISC-327)

The treatment of adsorption from binary liquid solution proposed by Kipling and Tester (*J. Chem. Soc.*, 4123(1952)) is criticized for its application of a unimolecular adsorption mechanism to porous adsorbents. It is shown that results of Kipling and Tester and others for adsorption by porous adsorbents from solution can be interpreted in a more consistent way through a pore-filling mechanism. It is pointed out that adsorption from solution should be comparable to adsorption from saturated vapors only if the area of liquid-vapor interface in the latter case is negligible compared to the surface area of the adsorbent, a condition generally satisfied by porous adsorbents. (auth)

SYNTHESES

4576

National Bureau of Standards
PREPARATION OF D-ARABINOSE-1-C¹⁴ AND D-RIBOSE-1-C¹⁴. Harriet L. Frush and Horace S. Isbell. May 14, 1953. 19p. (NBS-2309)

D-Arabinose-1-C¹⁴ and D-ribose-1-C¹⁴ were prepared in

yields of 30 and 8.5%, respectively, by the cyanohydrin method beginning with D-erythrose. (J.S.R.)

4577

Atomic Energy Project, Univ. of Rochester
A NEW SYNTHESIS OF DL-LYSINE-6-C¹⁴ AND DL- α -AMINOADIPIC ACID-6-C¹⁴. Morton Rothstein and C. J. Claus. Apr. 3, 1953. 11p. (UR-248)

A new and simple method for the preparation of DL-lysine-6-C¹⁴ and DL- α -aminoadipic acid-6-C¹⁴ has been described. The synthesis is based on the reaction of KC¹⁴N with ethyl α -acetamido- α -carbethoxy- δ -bromo-valerate to form a nitrile which by reduction followed by hydrolysis yields DL-lysine-6-C¹⁴. Direct hydrolysis of the same nitrile yields DL- α -aminoadipic acid-6-C¹⁴. (auth)

URANIUM AND URANIUM COMPOUNDS

4578

North American Aviation, Inc.
PHOTOMETRIC DETERMINATION OF URANIUM AS THIOCYANATE: PENTA-ETHER EXTRACTION METHOD. L. Silverman and L. Moudy. Submitted May 8, 1953. 25p. (NAA-SR-244)

At pH 1.5, uranium thiocyanate is extracted from aqueous solution into penta-ether, in the presence of excess thiocyanate ion. Chlorides do not interfere, but nitrates are not desirable. In a 25-ml extraction by penta-ether, 2 mg of Fe, 50 mg of Zr, 0.2 g of Al or 1 g of Th do not interfere. Three and one-half mg of U may be extracted into 25 ml of penta-ether; while, at the lower concentrations, 20 μ g of U may be clearly seen in 10 ml of extractant. Photometric readings are made, after 1 to 2 hr of standing, in the 350 m μ to 400 m μ range. Reagent blanks are not necessary except when μ g amounts of U are to be determined. (auth)

ENGINEERING

4579

Knolls Atomic Power Lab.
DEFORMATIONS AND STRESSES IN CIRCULAR CYLINDRICAL SHELLS CAUSED BY PIPE ATTACHMENT. PART 2. LINE LOADS ACTING ALONG GENERATRICES OF CIRCULAR CYLINDRICAL SHELLS. N. J. Hoff, J. Kempner, and F. V. Pohle. June 1952. 46p. (KAPL-922)

Mathematical foundations of the theory of deformations and stresses, caused in a cylindrical shell by pipes attached thereto, are developed. The equations of the theory of thin cylindrical shells are solved for the case in which the cylinder is subjected to line loads. (K.S.)

4580

Knolls Atomic Power Lab.
DEFORMATIONS AND STRESSES IN CIRCULAR CYLINDRICAL SHELLS CAUSED BY PIPE ATTACHMENT. PART 3. NUMERICAL METHODS. Frederick V. Pohle. Nov. 1952. 30p. (KAPL-923)

Numerical methods for simplifying the general equations of deformations and stresses in cylindrical shells, under various loads, are developed. Simplified expressions are within the limits of slide-rule accuracy. (K.S.)

4581

Knolls Atomic Power Lab.
DEFORMATIONS AND STRESSES IN CIRCULAR CYLINDRICAL SHELLS CAUSED BY PIPE ATTACHMENTS. PART 5. LOCAL EFFECT OF THE PIPE. N. J. Hoff. July 1952. 36p. (KAPL-925)

Mathematical treatment is given to the loading of a circular cylindrical shell by a radial pipe. Approximations and corrections are applied by use of the theory of circular plates rather than the general theory of shells. (K.S.)

4582

FIVE-BRANCH GAS FLOW VALVE. D. E. Nagle. *Rev. Sci. Instr.* **24**, 464(1953) June.

A simple two-position gas flow valve is described which, for a certain application, replaces five conventional two-way line valves. (auth)

HEAT TRANSFER AND FLUID FLOW

4583

Boeing Airplane Co.
GENERAL CONDENSER ANALYSIS. Daniel W. Gunnarson. Aug. 28, 1952. 22p. (D-13355)

The condenser is considered first from a theoretical point of view using basic and empirical heat-transfer and pressure-drop data. The various components of a finned-tube condenser are then analyzed separately, after which these results are combined to determine the over-all condenser performance. (auth)

4584

Boeing Airplane Co.
HEAT TRANSFER AND PRESSURE DROP GRID FOR PARALLEL FLOW CONDENSER. Wayne L. Wilson. Nov. 26, 1952. 15p. (D-13686)

A particular geometry of the parallel-flow condenser was analyzed to determine the condenser effectiveness and pressure drop as a function of weight flow of air and length. (auth)

4585

National Bureau of Standards
THE STRUCTURE OF TURBULENCE IN FULLY DEVELOPED PIPE FLOW. John Laufer. June 1953. 53p. (NACA-TN-2954)

Measurements, principally with a hot-wire anemometer, were made in fully developed turbulent flow in a 10-in. pipe at speeds of 10 and 100 fps. It is shown that rates of turbulent-energy production, dissipation, and diffusion have sharp maximums near the edge of the laminar sublayer and that there exist a strong movement of kinetic energy away from this point and an equally strong movement of pressure energy toward it. It is suggested that the flow field may be divided into three regions: wall proximity where turbulence production, transfer, and viscous action are of about equal importance; the central region of the pipe where energy diffusion predominates; and the intermediate region where the local rate of change of turbulent-energy production dominates the energy received by diffusive action. (auth)

4586

Administration, Research, and Engineering Labs., A. O. Smith Corp.
LIQUID METAL COOLANT HEAT EXCHANGERS: PROGRESS FOR MONTH ENDING MARCH 15, 1951. E. C. Koerper. Mar. 15, 1951. 6p. (NEPA-1782; ARL-HE-110)

4587

[Institute for Mathematics and Mechanics, New York Univ.]
SEMINAR ON MATHEMATICAL ASPECTS OF SUBSONIC AND TRANSONIC GAS DYNAMICS. [1951-1952] 106p. (NP-4550; ACC-1857)

Mathematical aspects of subsonic and transonic gas dynamics involved in the steady two-dimensional potential inviscous flow around closed profiles and in channels are discussed. (L.T.W.)

VACUUM SYSTEMS

4588

AN ELECTRICAL ANALOGUE TO A HIGH VACUUM SYS-

TEM. M. J. Aitken. *Brit. J. Appl. Phys.* **4**, 188(1953) June.

In a complex vacuum system where there are several pumping lines in parallel or where, as in synchrotrons and betatrons, the vacuum chamber is a toroidal tube of low pumping speed, the calculation of the effect on the pressure of altering various parts of the pumping system is tedious. Leak detection from observed pressure-gage readings is also laborious. An electrical analog is described which can be used to obtain the required answers quickly by simple voltage measurements. (L.T.W.)

MINERALOGY, METALLURGY, AND CERAMICS

GEOLOGY AND MINERALOGY

4589

Grand Junction Operations Office, AEC
METHOD OF OUTLINING AN ORE BODY BY MAXIMUM GAMMA LOG DEFLECTION VALUES ON POLAR MESA, GRAND COUNTY, UTAH. Richard A. Teichman, Jr.
Oct. 31, 1952. 12p. (RME-15)

At Polar Mesa, isorad maps prepared on the basis of maximum γ -ray deflection values within the ore-bearing sand have proved useful in outlining U ore bodies. This method is based solely on the use of the maximum value of the γ -ray deflection within the ore-bearing sand section. The procedure is time-saving, since the approximate grade of the ore and its lateral extension can be rapidly calculated. The application of the method to areas of low radioactivity is not recommended due to the resultant significance of small increases in background radioactivity. (auth)

4590

Utah Univ.
PRIMARY SEDIMENTARY TREND INDICATORS AS APPLIED TO ORE FINDING IN THE CARRIZO MOUNTAINS, ARIZONA AND NEW MEXICO; PART 1. TECHNICAL REPORT FOR APRIL 1, 1952 TO MARCH 31, 1953. William Lee Stokes. 48p. (RME-3043(pt.1))

Field and laboratory study of primary sedimentary features of the Salt Wash sandstone was undertaken to learn if these structures can be of use in finding hidden deposits of ore and also if they have influenced the localization of either individual ore deposits or larger mineralized district. The Carrizo Mountains area was selected as a test area for the study. Field mapping consisted of mapping of sedimentary features, collection of samples and analysis of relationships observed among visible geologic factors. Results may be summarized as follows: (1) Trends of current movement responsible for depositing the Salt Wash sand lenses can be mapped by use of primary structures of various kinds; (2) Patterns of trends determined at surface exposures can be used to help predict location of hidden ore bodies; (3) The large mineralized areas of the Carrizo area are located in major bends or curves of the Salt Wash sand lenses and are also in areas of abundant fossil plant material. There is a less well marked association of mineralization with areas near or at ancient stream junctions; (4) A suggestion that stream patterns were influenced by old tectonic features was noted. The inference is that ancient positive and negative areas created in Paleozoic time were exercising an influence on drainage during later time and are hence indirectly responsible for localization of large mineralized districts. (auth)

4591

Division of Raw Materials, AEC
POSSIBILITIES FOR URANIUM IN CERTAIN REGIONS OF SPAIN. Edward K. Judd, Helen E. DeSanctis, and Jean C. Brown. Issued June 1953. 27p., 3 illus. (RME-4009)

The possibilities of the existence of U in four particular regions of Spain are discussed. Data on known or supposed occurrences, including the most significant features in these regions, are briefly tabulated. Since it is indicated that the geology of Spain offers very favorable environments for mineralization by U, these areas should be systematically surveyed by radiometry. (J.E.D.)

4592

Geological Survey
RECONNAISSANCE FOR RADIOACTIVE DEPOSITS IN THE DARBY MOUNTAINS DISTRICT, SEWARD PENINSULA, ALASKA. Walter S. West. Mar. 1953. 26p., 1 illus. (TEI-53)

Radioactivity in the Darby Mountains district of the Seward Peninsula, Alaska, appears to be directly related to the occurrence of granite. Concentrates from placers derived from areas containing granite are more radioactive than concentrates from placers not derived from the granite and, generally, contain from 0.01 to 0.05% equivalent U. The radioactivity of these concentrates is largely due to radioactive elements in common accessory minerals in granite, such as sphene, allanite, and zircon, and locally, monazite. Locally, in the Clear Creek-Vulcan Creek area, the headwaters of the Kwiniuk River, and on Golovin Bay near McKinley Creek, concentrates from placers derived from granitic terrain contain as much as 0.1% equivalent U. The higher radioactivity of the concentrates from the Clear Creek area and on Golovin Bay is due chiefly to an unidentified U-Ti niobate, whereas the higher radioactivity at the headwaters of the Kwiniuk River is due to thorianite. (auth)

4593

Geological Survey
MINERALOGIC STUDY OF SOME JURASSIC AND CRETACEOUS CLAYSTONES AND SILTSTONES FROM WESTERN COLORADO AND EASTERN UTAH. Alice Dowse Weeks. Feb. 1953. 22p. (TEI-285)

The clay minerals and water-soluble minerals identified in 50 samples of siltstone and claystone representing formations from the Summerville formation of Jurassic age to the Dakota sandstone of Cretaceous age suggest some distinctive characteristics for these formations and some differences in source area or environment of deposition. Hydromica predominates in the samples of Summerville, Salt Wash member of the Morrison, and Burro Canyon formations, whereas montmorillonite derived from volcanic ash is found in the Brushy Basin member of the Morrison formation, and kaolinite in the Dakota sandstone is probably related to the regional unconformity at the base of the Dakota. Semiquantitative spectrographic analyses show the chief chemical constituents in the order of magnitude indicated by the minerals. Size analyses show that most of the samples are siltstones. (auth)

4594

Geological Survey
ANNOTATED BIBLIOGRAPHY OF PAPERS ON GEO-CHEMICAL PROSPECTING FOR ORES. H. E. Hawkes, comp. Aug. 1948. 6p. (GS-C-28)

This bibliography is a list of papers dealing with geochemical prospecting for ores. This field includes methods of exploration for metallic and nonmetallic mineral deposits by chemical studies of ore elements in soil, vegetation, and water. No papers on general geochemistry are included in this list, nor are there references to geochemical prospecting for petroleum which has been adequately covered in the Geophysical Abstract series. Papers on analytical

methods are listed only where the subject matter is directly related to geochemical prospecting problems. (auth)

METALS AND METALLURGY

4595

[Johns Hopkins Univ.]

THE BENDING OF MOLYBDENUM SINGLE CRYSTALS.

K. T. Aust, R. Maddin, and N. K. Chen. May 1953. 22p. (NP-4601; Technical Report 7)

Molybdenum single crystals were subjected to deformation by bending in order to determine the reaction of the body-centered cubic lattice to bending stresses. A summary of the slip elements determined is presented in tabular form. Lattice rotation during bending of Mo single crystals was found to occur toward the {110} pole on the comparison side and toward the <111> direction on the tension side. Crystallite rotation determined from asterism and observations of slip traces appeared to indicate the participation of the {110} planes and the <111> directions. The results support the suggestions that the slip planes are of the type {110} and the slip direction <111> for Mo single crystals deformed at room temperature. The orientation change on the compression and tension sides of a Mo single crystal during bending were found to be similar to that of two separate crystals deforming under compression and tension loading, respectively. (auth)

4596

General Electric Research Lab.

THERMODYNAMIC ACTIVITIES IN IRON-NICKEL ALLOYS. R. A. Oriani. Apr. 1953. 21p. (SO-2028; RL-863)

The activity of Fe in Fe-Ni alloys was studied in differential apparatus by equilibrating mixtures of H₂O/H₂ gases over pure Fe and over the alloys. Errors due to thermal diffusion are minimized in this design, and the measured activity of Fe is corrected for the variation of the activity of wüstite with ambient gas composition. Formation of magnetite prevents the investigation of Ni-rich alloys. In the Fe-rich f.c.c. alloys, the solid solution is very nearly ideal; the activity coefficients are generally only slightly smaller than unity, the entropies of mixing are slightly larger than the ideal values, and the heats of mixing are small positive numbers. (auth)

4597

Armour Research Foundation

PHASE DIAGRAMS OF THE TITANIUM-ALUMINUM, TITANIUM-CHROMIUM-IRON, AND TITANIUM-OXYGEN ALLOY SYSTEMS. R. J. Van Thynne, E. S. Bumps, H. D. Kessler, and M. Hansen. Dec. 1952. 86p. (WADC-TR-52-16)

Phase diagrams of the systems Al-Ti, Cr-Ti, Fe-Ti, Cr-Fe-Ti, and O-Ti are shown, and the following characteristics are discussed: peritectoid reactions, transformation temperatures, solubility limits, crystal structure, x-ray-diffraction patterns, composition studies, hardness, and melting temperatures. (L.T.W.)

4598

Barus Research Lab. of Physics, Brown Univ.

CORROSION AND PASSIVITY STUDIES WITH TITANIUM; INTERIM TECHNICAL REPORT [FOR] JULY 1, 1952-MAY 1, 1953. H. E. Farnsworth and A. M. Russell. May 1953. 58p. (WAL-401-143-3; Interim Technical Report 1)

The purpose of this investigation is to attempt to correlate the adsorption of gases on Ti with the passivity of the metal. The first objective is a study of the removal of the gas and of the electron diffraction patterns of the Ti crystal. The crystal structure is discussed and the electron diffraction beam calculated. The vacuum system used for degassing the Ti crystal is described in detail. The electron

diffraction beams obtained in preliminary tests are discussed, and tentative conclusions are drawn. (J.S.R.)

4599

THERMAL FATIGUE OF SINGLE CRYSTALS OF ALUMINUM. V. I. Arkharov, S. I. Ignatyeva, and Yu. D. Kozmanov. Translated from Doklady Akad. Nauk S.S.S.R. 88, 439(1953). 2p. (NSF-tr-3; D-88-439)

Thermal fatigue experiments on Al single crystals indicate that the larger the sample the sooner the changes in the Laue spots occur. Thermal fatigue does not extend uniformly throughout the sample, but after a certain number of cycles, the samples transform until the diffusion of the spots on the x-ray photographs stop, and the spots become as sharp as before the cyclic treatment. The depth of transformed layer grows with increase in number of thermal cycles. The diffusion of the Laue spots reappears after further cyclic treatment. The cause of the structural transformations is the plastic deformation produced during each thermal cycle by temperature stresses introduced by the temperature gradient. (L.T.W.)

4600

EFFECT OF PLASTIC DEFORMATION ON SUBSEQUENT DECOMPOSITION IN ALUMINUM ALLOYS Al-Si AND Al-Mg-Si. N. N. Buinov and V. P. Savinykh. Translated from Doklady Akad. Nauk S.S.S.R. 88, 257(1953). 4p. (NSF-tr-9; D-88-257)

The effect of plastic deformation on subsequent decomposition in the alloys Al-Si (1.2% Si) and Al-Mg-Si (1.4% Mg₂Si) was studied with an electron microscope. The samples in the form of bars and rods were compressed and stretched. In the Al-Si alloy the deformation accelerated decomposition. In the Al-Mg-Si alloy plastic deformation had no significant effect. (J.S.R.)

4601

TEXTURES IN EXTRUDED ALUMINUM. K. V. Gow and R. W. Cahn. Acta Met. 1, 238-41(1953) Mar.

The deformation and recrystallization textures in extruded rods of superpure Al requires abandonment of the theory that preferred orientation is entirely due to a supply of nuclei of special orientations. The theory that the mechanism of deformation is irrelevant to the subsequent recrystallization behavior except as it affects the supply of nuclei and their range of orientation does not completely explain the recrystallization of Al. However, a combination of this theory with the idea that recrystallization nuclei are minute, intensely curved lattice regions which have polygonized and are, thus, strain-free does explain the behavior in extruded Al rods. (J.S.R.)

4602

A NOTE ON TWINNING IN ALPHA-URANIUM. F. C. Frank. Acta Met. 1, 71-4(1953) Jan.

The crystal structure of alpha U resembles that of Zn but has lower symmetry. Comparison of the two helps to classify the twinning modes of the more complex case. The lowering of the symmetry gives rise to new twinning modes in two ways: because the reciprocals of some of the Zn modes become distinct twinning modes of the second kind; and by the operation of Mallard's law, according to which each lost symmetry plane may become a twinning plane. Most, perhaps all, of the twinning modes of U are thus accounted for. Among reciprocal pairs of modes, the twinning of the second kind seems to be the easier; the reason for this is discussed. (auth)

4603

THE PREPARATION OF ALPHA-URANIUM CRYSTALS. R. W. Cahn. Acta Met. 1, 176-84(1953) Mar.

Applications of the strain-anneal and phase-change methods to the growth of alpha-U single crystals in U are described. While the strain-anneal method gave crystals

which were structurally perfect, none were more than $2\frac{1}{2}$ mm in diameter, probably owing to the occurrence of twinning during deformation. By the phase-change method large, but imperfect, grains were obtained. The hypothesis is put forward that the "cells" in these imperfect grains are the consequence of kinking in the α phase at its interface with the β phase. This kinking is attributed to the change of volume accompanying the transformation. (auth)

4604

YIELD POINTS IN ALUMINIUM ALLOY SINGLE CRYSTALS.

R. E. Smallman, G. K. Williamson, and G. Ardley. *Acta Met.* **1**, 126-30(1953) Mar.

Experiments have been made to compare the tensile behavior of some Al-alloy single crystals which contained Cu, Zn, or H, with that of superpure Al crystals. Sharp yield points were observed in all the alloys when tested at liquid-air temperature, but the superpure crystals showed no capacity for producing a yield point. These results are discussed from the standpoint of the dislocation theory of the yield point. (auth)

4605

ACTIVATION ENERGIES AND DIFFUSION COEFFICIENTS OF OXYGEN AND NITROGEN IN NIOBIUM AND TANTALUM. C. Y. Ang. *Acta Met.* **1**, 123-5(1953) Mar.

With the use of the torsional-pendulum method of internal friction measurement, the heats of activation for diffusion of O_2 and N_2 in Nb were found to be 27.6 and 38.6 kcal/mole, respectively. For O_2 and N_2 in Ta, the corresponding values of 27.3 and 39.8 kcal/mole were determined by the low-frequency method coupled with a new high-frequency technique. The theoretical diffusion-coefficient curves for these systems were obtained from the relationship between heats of activation and the calculated diffusion-coefficient constants. An agreement, closer than before, between the experimental and theoretical values of entropy of activation was obtained from an analysis of this thermodynamic property. (auth)

4606

CRYSTALLOGRAPHIC ASPECTS OF THE BETA TO ALPHA PHASE TRANSFORMATION IN TITANIUM. J. B. Newkirk and A. H. Geisler. *Acta Met.* **1**, 370-4(1953) May.

Three aspects of the β -to- α transformation in commercially pure Ti are discussed. (1) The orientation of the α lattice with respect to its parent β lattice was determined. (2) The striations in the microstructure were found to have no simple relationship to the orientations of the former β lattice; the habit plane for the acicular product had the same relationship to the β phase as the striations. (3) Isolated α crystals which were cycled through the critical temperature or held for many hours at 1000°C usually failed to become polycrystalline or even to show a change in the orientation of the original α grain on cooling. (J.S.R.)

4607

THE INTERNAL FRICTION OF TANTALUM AND COLUMBIUM FOILS AT ULTRASONIC FREQUENCIES. J. W. Marx, G. S. Baker, and J. M. Sivertsen. *Acta Met.* **1**, 193-201(1953) Mar.

The internal friction and effective elastic moduli of polycrystalline Ta and Nb foils were measured at vibrational frequencies of about 37 and 111 kc. Relaxation effects readily identified with O and N impurities were observed and correlated with the low-frequency data of other investigators. Activation energies for O and N diffusion in both Ta and Nb were observed to decrease with increasing temperature, while the internal friction peaks were shifted upward on the temperature scale when the impurity content was increased. Measurements extended over the temperature interval from about -160 to about 1000°C. Low-temperature anomalies in the internal friction of Ta are be-

lieved to be caused by H. Room-temperature plastic deformation of both Ta and Nb produced large, but poorly defined, decrement increases between 20 and 200°C, a range which showed no anomalies for annealed specimens. (auth)

4608

THE FORMATION OF INTRACRYSTALLINE VOIDS IN SOLUTION-TREATED MAGNESIUM-ALUMINIUM ALLOYS. E. Lardner. *J. Inst. Metals* **81**, 439-42(1953) May.

It has been observed that occasionally the solution-treatment of cast Al-Mg alloys results in the formation of small hexagonal voids in the center of many grains. These voids have been shown to be orientated with their hexagonal axes parallel to the hexagonal axes of the crystals in which they occur. No explanation has been found for their formation, but it has been shown that in a sample of an alloy that does form cavities, the cavity formation increases to a maximum and then eventually vanishes with increasing homogenization. It has also been shown that the cavities are probably produced on cooling after solution-treatment rather than during the progress of the heat-treatment. (auth)

PHYSICS

4609

Radiation Lab., Univ. of Calif., Berkeley ELECTROLYTIC TANK MEASUREMENTS OF THE FIELDS OF HYPERBOLIC ELECTRODES. E. L. Hubbard and C. S. Nunan. June 4, 1953. 12p. (AECU-2579)

4610

Ames Lab. QUARTERLY SUMMARY RESEARCH REPORT IN PHYSICS FOR OCTOBER, NOVEMBER, [AND] DECEMBER 1952. May 1, 1953. 21p. (ISC-322)

Progress is reported on the following studies: intermediate-image β spectrometer studies of Rb^{86} and Pr^{142} , half lives of Li^8 and N^{12} , energy distribution of protons from Al and Ta bombarded with 40- and 65-Mev bremsstrahlung, fission-fragment ionization defect, thermal conductivity and thermal diffusivity of U, electric resistivity and Hall coefficient of Na_xWO_3 , Hall coefficients of rare-earth metals, and lattice constants and magnetic properties of Dy. (For preceding period see ISC-301.) (L.T.W.)

4611

Radiation Lab., Univ. of Calif., Berkeley SUMMARY OF THE RESEARCH PROGRESS MEETINGS OF FEBRUARY 12, 19, AND 26, 1953. Sergey Shewchuck. May 8, 1953. 8p. (UCRL-2209)

A New Short-Half-Life Ci^{32} . J. R. Richardson. When S was bombarded with protons, a γ activity of half life 0.31 ± 0.01 sec and energy 4 Mev was observed, probably due to Ci^{32} . Gamma activities of 7.2 ± 0.2 , 4.4 ± 0.2 , and 2.9 ± 0.2 Mev were observed from the proton bombardment of Al^{24} . Biological Studies with High-Energy Deuterons. C. A. Tobias. This talk has been summarized in abstract reports UCRL-1986 by C. A. Tobias, et al., and UCRL-2118 by Ann C. Birge. Physics Research in Israel and Plans for the Future. Samuel Sambursky. The general extent of scientific research in Israel is briefly summarized. Proposed Mass Spectrograph Using Strong-Focusing Principles. R. Post and L. Henrich. The possibility of mass spectroscopy, utilizing resonance stability and instability as described by the Mathieu equation, is discussed. 80-Mev Neutron Cross Section in Pb. Boris Ragent. The results indicate a dip in

the cross section at ~ 55 Mev followed by a rise and fall to a smooth drop off. **Visibility of X Rays.** Leo Lipetz. The talk was based on report UCRL-2056, entitled "An Electro-physiological Study of Some Properties of the Vertebrate Retina." (L.T.W.)

4612

THE ELECTRICAL PROPERTIES OF GRAPHITE. G. H. Kinchin. *Proc. Roy. Soc. (London)* A217, 9-25(1953) Mar.

The Hall coefficient and resistivity of a range of polycrystalline graphites with different crystal sizes and a single crystal of Travancore graphite have been measured over a wide range of temperature. The number of free electrons has been found to be approximately $6 \times 10^{18}/\text{cm}^3$ at room temperature; the variation with temperature cannot be accurately determined. The deficit of electrons in poorly crystalline graphite gives rise to positive Hall coefficients. Quenching removes electrons, and a study of this process has enabled the ratio of the mobilities of positive holes and electrons to be estimated at 0.80. An interesting effect has been observed in the variation of the Hall coefficient of the single crystal with field; no satisfactory explanation has been found for this phenomenon. The resistivity of polycrystalline graphite depends on the density and on the orientation and size of the crystals. From the variation of resistivity with temperature and the size of the crystals, the mean free path due to thermal scattering has been found to be 2350 Å at 273°K; the variation of mean free path with temperature has been deduced. The product of effective mass and velocity of the free electrons has been determined as a function of temperature; the accuracy is limited by uncertainties in the number of free electrons. (auth)

4613

ALPHA-PARTICLE IONIZATION IN PURE GASES AND THE AVERAGE ENERGY TO MAKE AN ION PAIR. William P. Jesse and John Sadauskis. *Phys. Rev.* 90, 1120-1(1953) June 15.

Results of measurements of W , the energy required to produce an ion pair by $\text{Po } \alpha$ particles in pure gases, are presented for several gases and comparison made with the measurements available from the literature. A short collimating system directed the α particles along the axis of a long cylindrical ionization chamber, the effective path length being ~ 20 cm. The ions were collected and measured by a method previously described (*Phys. Rev.* 77, 782(1950); *Phys. Rev.* 88, 417(1952)). It is noted that the ratios of W to the ionization potentials of Ne, He, Ar, and Kr are constant at ~ 1.71 , and for Xe the ratio is only slightly higher. (L.M.T.)

COSMIC RADIATION

4614

AN UNUSUAL EXAMPLE OF V^0 DECAY. R. W. Thompson, A. V. Buskirk, L. R. Etter, C. J. Karzmark, and R. H. Rediker. *Phys. Rev.* 90, 1122-3(1953) June 15.

An event, thought to be another example of V^0 -particle decay, is described. The V^0 particle, occurring with a penetrating shower, decayed after traversing about $\frac{1}{2}$ of the illuminated height of the cloud chamber. The decay takes place near the center of the illuminated depth, the positive fragment (43 cm track length) being projected almost vertically down and the negative fragment almost horizontally to the right. A discussion is presented concerning the possible interpretations of the event. (L.M.T.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

4615

Cornell Univ.

STRUCTURES OF FLUOROCARBONS, ELEMENTARY

BORON, AND BORON COMPOUNDS. J. L. Hoad. July 1, 1953. 6p. (NYO-3944)

The accurate spectrometrically measured (hk0) intensity data from a single crystal of B have been used to derive accurate x and y atomic coordinates within the unit cell. Agreement between calculated and observed amplitudes of reflection is excellent. The Fourier projection of electron density on (001) of the tetragonal crystal gives definite evidence for the presence of occasional "extra" B atoms in "holes" within the framework earlier described. Evaluation of the z coordinates is in progress. Further variations in lattice constants, presumably to be correlated with variations in concentration of "extra" B atoms in the structure, have been encountered. (auth)

ELECTRICAL DISCHARGE

4616

Institute for the Study of Rate Processes, Univ. of Utah
INDUCTION OF CHEMICAL REACTIONS IN A HIGH FREQUENCY DISCHARGE. 7. KINETICS OF CARBON DIOXIDE DECOMPOSITION. Kenneth A. Wilde, Bruno J. Zwolinski, and Ransom B. Parlin. May 15, 1953. 64p. (AECU-2582; Technical Report 7)

A study was made of the chemical processes responsible for CO_2 decomposition in a h-f discharge. A convenient glass flow system was employed in which the effect of various parameters such as pressure, flow rate, gap distance, and current on the decomposition of CO_2 was measured. The product gases were found to consist essentially of CO_2 , CO, and O_2 . Yields decreased more or less exponentially with increasing flow rate but increased linearly with increasing current. Yields decreased slightly with increasing current but were virtually independent of gap distance, surface, and frequency. (L.T.W.)

4617

FORMATIVE TIME LAGS IN THE ELECTRICAL BREAKDOWN OF GASES. J. Dutton, S. C. Haydon, and F. Llewellyn Jones. *Brit. J. Appl. Phys.* 4, 170-5(1953) June.

The time rate of growth of ionization currents in a gas in a uniform electric field greater than that corresponding to the static sparking potential is investigated theoretically. This theoretical analysis is then applied to the breakdown of a gas at high values of the parameter pd . It is shown that the same primary and secondary ionization processes which lead to a growth of pre-breakdown currents in agreement with experiment, and to the calculation of static sparking potentials in agreement with those measured, also lead to a rapid decrease of the formative time lag with increasing overvoltage. The introduction of some other quite different process to account for the short formative time lag is unnecessary. The present theoretical investigation, together with previous experimental and theoretical studies, therefore, lay the basis of a comprehensive view of the electrical breakdown of gases covering a wide range of parameters. Curves showing the dependence of the formative time lag on overvoltage, calculated by means of the above analysis, are given; these curves may be used to elucidate the various secondary ionization processes operative in the breakdown mechanism. (auth)

GASES

4618

Massachusetts Inst. of Tech.

THE HEAT CONDUCTIVITY, VISCOSITY, SPECIFIC HEAT AND PRANDTL NUMBERS FOR THIRTEEN GASES. Frederick G. Keyes. Apr. 1, 1952. 35p. (NP-4621; Technical Report 37)

Measurements of heat conductivity at temperatures above

the upper range of reported data were obtained. No measurements to temperatures approaching 1000°C are given in this report. Heat conductivity measurements for thirteen gases are compiled in the form of tables, computed from formulations which include all available information. Data for the first temperature range in the case of the mixture N_2 - CO_2 are also given. Viscosities and specific heats are also included in the tables, all for zero pressure. (auth)

INSTRUMENTS

4619

Department of Mines and Technical Surveys, Mines Branch, Ottawa (Canada)

A FAST-RATE VARIABLE PULSE GENERATOR. J. C. Baker. May 2, 1953. 6p. (NP-4600; TR-109/53)

A flexible pulse generator is described which is capable of supplying pulses up to 40 v in amplitude over a repetition frequency range from 0.8 to 330,000 pps. Provision is made for internal or external triggering and the pulse width is continuously variable from 0.1 to 50 μ sec. A 6BN6 is employed as the final pulse-shaping tube, providing a very uniform output pulse at all frequencies. (auth)

4620

Rochester Univ.

THE TYPE 6218 BEAM DEFLECTION TUBE AS A COMPLEX PULSE GENERATOR. K. Enslein. June 15, 1953. 21p. (NYO-3825)

The type 6218 tube provides a simple means of obtaining pulses of very fast rise time, unlimited to the repetition rates of the order of 150 pps, as obtained with Hg switch pulsers. It also provides a means of generating double or n pulses of variable separation at repetition rates limited only by the separation of the pulses. The tube should find applications in equipment for testing the resolution of scalars, coincidence circuits, etc. (auth)

4621

Atomic Energy Project, Univ. of Calif., Los Angeles
A CONTINUOUSLY RECORDING RADIATION BACKGROUND MONITOR FOR FIELD USE. William R. Kennedy. Issued June 12, 1953. 9p. (UCLA-258)

A portable, battery-operated instrument for monitoring and recording β and γ radiation in the field is described. Several requirements had to be satisfied; the instrument should indicate background of β and γ of 0 to 20 mr/hr for nine instruments and background of γ of 0 to 50 r/hr for three instruments, be battery-operated for portable field use, have negligible drift for 24-hr operation, be economically constructed by utilizing existing available equipment, be able to withstand the mechanical shocks of driving over rough terrain, and be dust and moisture proof. During field use the instruments were found to meet the requirements satisfactorily. (auth)

4622

Radiation Lab., Univ. of Calif., Berkeley

AN ELECTRONIC VOLTAGE INTEGRATOR. Richard Madey and George Farly. Apr. 20, 1953. 22p. (UCRL-2189)

An electronic voltage integrator has been used by the magnetic measurements program of the Berkeley Radiation Lab. since 1948. The device can explore magnetic fields in the range from 500 to 15,000 gauss to an accuracy of better than 1%. The heart of the integrator consists of a direct-coupled high-gain amplifier that is connected in a "feedback time constant" circuit. The amplifier uses the cascode connection, the filament drift compensation circuit of Miller, and an internal positive feedback adjustment for "infinite" gain. Some other features of the integrator amplifier include low grid-current operation, large linear output range, and provision for adjustment of the input and the output voltages to zero potential when no signal is present. (auth)

ISOTOPES

4623

Argonne National Lab.

ISOTOPIC EXCHANGE REACTIONS OF NEPTUNIUM IONS IN SOLUTION. 1. THE $Np(V)$ - $Np(VI)$ EXCHANGE. Donald Cohen, J. C. Sullivan, and J. C. Hindman. May 1953. 7p. (ANL-5042)

The isotopic exchange reactions between NpO_2^+ and NpO_2^{++} in 1M $HClO_4$ at 0 and 25°C has been found to be complete in one minute. This result is interpreted in terms of an electron transfer mechanism for a homogeneous exchange reaction. A correlation between the rate of an electron exchange reaction and the difference in the partial molal entropies of the two reacting species is proposed. (auth)

4624

Radiation Lab., Univ. of Calif., Berkeley

TABLE OF ISOTOPES. J. M. Hollander, I. Perlman, and G. T. Seaborg. Dec. 1952. 181p. (UCRL-1928(rev.))

A complete list is presented of all the radioactive and stable isotopes of the elements, together with a number of their salient features, as recorded in the literature or by private communication by approximately December, 1952. A primary objective has been to retain as much of the compactness of the previous editions as is consistent with an adequate coverage of the multitudes of nuclear data presently available. (auth)

MASS SPECTROGRAPHY

4625

Carbide and Carbon Chemicals Co. (K-25)

AN ELECTRON BOMBARDMENT ION SOURCE FOR MASS SPECTROMETRY OF SOLIDS. A. E. Cameron. Issued June 19, 1953. 7p. (K-1021)

An ion-source structure is described which is specifically designed for slow-electron ionization of vapors of salts. This may be used up to 550°C. The ion chambers are rapidly interchangeable and memory effects between samples are undetectable over moderate changes in concentration. Some of the characteristics of this source are discussed and its advantages indicated. (auth)

4626

ANGULAR ABERRATIONS IN SECTOR SHAPED ELECTROMAGNETIC LENSES FOR FOCUSING BEAMS OF CHARGED PARTICLES. Edgar G. Johnson and Alfred O. Nier. *Phys. Rev.* **91**, 10-17(1953) July 1.

The general expression for the second-order angular aberration of sector-shaped electromagnetic lenses consisting of superimposed uniform magnetic and radial electric fields used for the plane focusing of diverging beams of charged particles is derived. The result is applied to the special cases of pure magnetic and pure electric field lenses. The ion optics of a mass spectrometer employing sector electric and magnetic lenses in tandem and which has first-order velocity focusing and second-order angular focusing is obtained. (auth)

MATHEMATICS

4627

General Electric Co., ANP Project

THE EVALUATION OF INTEGRALS OF THE FORM $\int_0^\beta e^{-\alpha/\sin\phi} \sin^n\phi \cos^m\phi d\phi$ AND CERTAIN RELATED INTEGRALS. Fritz W. Mezger. May 15, 1953. 53p. (DC-53-5-4)

This report gives a method of evaluating such integrals as the above, involved in shielding problems and reactor problems, in terms of existing function tables. (J.A.G.)

4628

National Bureau of Standards, Los Angeles

BIBLIOGRAPHICAL SURVEY OF RUSSIAN MATHEMATICS

CAL MONOGRAPHS, 1930 TO 1951. George E. Forsythe, comp. Mar. 25, 1952. 68p. (NBS-1628)

4629

National Bureau of Standards, Los Angeles
BIBLIOGRAPHICAL SURVEY OF RUSSIAN MATHEMATICAL MONOGRAPHS, 1930 TO 1951; SUPPLEMENT. George E. Forsythe, comp. Dec. 12, 1952. 20p. (NBS-1628A)

MEASURING INSTRUMENTS AND TECHNIQUES

4630

Knolls Atomic Power Lab.
LIQUID SAMPLE BETA COUNTER: A NEW LABORATORY COUNTING FACILITY. D. L. Douglas. Mar. 9, 1953. 14p. (KAPL-Memo-DLD-3)

Following an ORNL design, a liquid-sample beta counter capable of detecting levels of activity down to about $1 \mu\text{Ci/ml}$ in liquids has been constructed. It consists of a G-M tube of 0.2 mil Pliofilm. The sample is placed in a polyethylene cup which, in turn, is held in an Al cylinder. The cylinder is attached to the shaft of a synchronous motor that spins the liquid to the sides of the cup, resulting in a vertical wall of liquid extending its length. The counter is inserted in the cylindrical "hole" in the liquid, thus having access to a large liquid surface and eliminating contamination by keeping the counter out of contact with the liquid. Operating characteristics are given. (J.A.G.)

4631

NEPA Div., Fairchild Engine and Airplane Corp.
A SENSITIVE BF_3 IONIZATION CHAMBER. Eugene V. Haake. Apr. 4, 1951. 13p. (NEPA-1742)

The construction and operating characteristics of a sensitive BF_3 ionization chamber with an output current of 10^{-9} amp or greater at a thermal neutron flux of 10^3 counts/cm²/sec² are briefly described. It was necessary that the operating characteristics of the chamber be unaffected by the corrosive action of BF_3 and that the effect of leakage currents be negligible compared to the output current of the chamber. (L.T.W.)

4632

NEPA Div., Fairchild Engine and Airplane Corp.
THE PHOTOMULTRON, A GAMMA RAY DETECTING INSTRUMENT FOR CONTROL PURPOSES. Hugh W. Maxwell. Mar. 7, 1951. 9p. (NEPA-1744)

A description of a γ -ray detection instrument which is based on the scintillation photomultiplier-tube principle is presented. This instrument is designed for use as part of the safety system for a nuclear reactor. (auth)

4633

Armour Research Foundation
FUNDAMENTAL STUDIES ON SCINTILLATION PHOSPHORS: QUARTERLY REPORT [FOR] PERIOD SEPTEMBER 1952 TO DECEMBER 1, 1952. L. Reiffel and R. F. Humphreys. Jan. 26, 1953. 32p. (NP-4611; Quarterly Report 2; Technical Report 1)

In a study of afterglow it was found that, in addition to very short-lived traps in NaI(Tl), there exist at least two long-lived groups ranging in lifetime from ~60 sec to perhaps 100 min. Most if not all characteristics of the afterglow of NaI(Tl) can be accounted for by the shallow trap-deep trap model of phosphorescent materials. The long-lived traps contribute a spectral shift away from the fluorescence wavelengths that increases in magnitude with time after excitation. Partial optical discrimination against afterglow is possible. Quenching of some afterglow components should be possible. The very long-lived afterglow probably is associated with F-center formation and subsequent bleaching. (L.T.W.)

4634

Naval Research Lab.
A HIGH-RESOLUTION HIGH-INTENSITY-SCINTILLATION

DETECTOR. W. C. Hall, B. M. Horton, J. W. Keller, and S. H. Liebson. Jan. 22, 1952. 17p. (NRL-3927)

The scintillation detector described consists of a coaxial phototube with an opaque photocathode as center conductor and a mesh-type anode as outer conductor, surrounded by a cylindrical sleeve of scintillating material. Design and performance characteristics are given. (J.A.G.)

4635

Atomic Energy Project, Western Reserve Univ.
A CONTINUOUS RECORDING DETERMINATION OF THE DISAPPEARANCE OF RADIOACTIVE TRACERS FROM CIRCULATING BLOOD. William J. MacIntyre and Jack R. Leonards. Issued Apr. 21, 1953. 16p. (NYO-4029)

By cannulation of the right femoral artery of dogs and leading the tubing past a scintillation counter into the right femoral vein a complete circuit is established so that the concentration of radioactivity may be continuously monitored. Curves showing concentration of the radioactive material vs. time have been obtained following injection of iodinated (I^{131}) plasma, Na^{24} , I^{131} , P^{32} , K^{42} , and colloidal Au^{198} . By this continuous system no errors are introduced by sample withdrawal, timing of samples, or geometric variations. Points may be recorded as often as once per second for fast disappearances with an accuracy dependent only on statistical variation of counting rates and the accuracy in transposing the counting rate from the chart recorder.

(auth)

4636

A CONVENIENT ASSEMBLY FOR $\hat{\text{C}}\text{ERENKOV}$ COUNTERS USING HEAD-ON TYPE PHOTOMULTIPLIER TUBES. Roger H. Hildebrand. *Rev. Sci. Instr.* **24**, 463-4(1953) June.

A simple Cherenkov-counter assembly is described which adequately solves the usual problems of light shielding, magnetic shielding, and a dependable seal between the liquid container and the glass envelope of the photomultiplier tube. An ordinary 6-oz tin can lined with Al foil is used as the liquid container, which, besides being the same diameter as the photocathode, has a thin wall (0.008 in.) which aids in reducing γ conversion in the container. Tests of the counter in a beam of 145-Mev π mesons show it to have a very high efficiency. (L.M.T.)

4637

IMPROVEMENT IN RESPONSE OF 4π GAMMA-IONIZATION CHAMBERS. C. C. Smith and H. H. Seliger. *Rev. Sci. Instr.* **24**, 474(1953) June.

Slight modifications which have resulted in increased response of 4π gamma ionization chambers are discussed. A thin brass cylinder is used as the collecting electrode instead of the usual wire cage. In addition, the re-entrant cylinder into which the source is introduced is insulated from the main body of the chamber and is grounded. The chamber is now operated in air at atmospheric pressure with resulting reductions in construction and maintenance costs. Comparison curves show the cylindrical electrode to have a much flatter response than the wire-cage electrode. (L.M.T.)

4638

NEUTRON DETECTORS FOR REACTOR INSTRUMENTATION. T. A. J. Jaques, H. A. Ballinger, and F. Wade. *Proc. Inst. Elec. Engrs. (London)* **100**, Pt. I, 110-16 (1953) May.

This paper discusses the principles involved in the detection of thermal neutrons and describes three types of detectors used in the operation of natural-U-graphite-moderated reactors, namely flux-scanning detectors, installed flux monitors, and detectors used in association with automatic power-control plants. Flux-scanning detectors consist of linear assemblies of Chromel-Alumel thermocouples with alternate junctions coated with B. Installed flux monitors employ disks of boron steel in

place of the B beads. Ionization chambers may be used as installed flux monitors, and they are also used for the starting-up and control of nuclear reactors; designs and characteristics of the standard chambers are given. The problem of the γ -ray sensitivity of such chambers is considered, and a design of a compensated chamber is described in which the sensitivity to γ rays is reduced by a factor of 160. It is thought that compensated chambers of this type will be much used for the measurement of power level in future nuclear reactors, particularly in automatic power-control apparatus. (auth)

4639

ČERENKOV DETECTORS. J. V. Jelley. *Atomics* 4, No. 4, 81-90, 100(1953) Apr.

The nature and methods of detection of Cherenkov radiation are reviewed. Practical applications of Cherenkov detectors are also included. (L.T.W.)

4640

TWO-CRYSTAL GAMMA-RAY SCINTILLATION SPECTROMETER. R. E. Connally. *Rev. Sci. Instr.* 24, 458-9(1953) June.

An arrangement is described for reducing the smearing effects of Compton scattering from the higher-energy regions on the lower-energy photopeaks in γ spectral measurements. A small NaI crystal contained in an Al cup and covered with mineral oil is placed inside a larger covered NaI guard crystal. Emitted light is collected by two 5819-type photomultipliers placed above and below the crystals. The pulses from the smaller crystal are amplified and fed to a single-channel differential pulse-height analyzer. The pulses from the larger crystal are operated in anticoincidence with those from the smaller crystal. Reductions in the Compton continuum from In^{114} , Cs^{137} , and Co^{60} of 57, 60, and 50%, respectively, have been obtained. (L.M.T.)

4641

A TROCHOIDAL ANALYZER FOR CHARGED PARTICLES. Bernd Crasemann. *Rev. Sci. Instr.* 24, 470-1(1953) June.

A device which will discriminate against the sign, but not the energy, of charged particles emitted by radioactive samples has been found useful in work on relatively short-lived isotopes. The magnetic analyzer described makes use of the trochoidal orbit of electrons and positrons in a cylindrically symmetric magnetic field with a radial gradient. The orbit is energy-independent, except for the diameter of the individual loops of the trochoid. With a scintillation counter as detector, the sensitivity of the apparatus can be adjusted to 0.2 %. (auth)

4642

A SEMICIRCULAR PERMANENT MAGNET BETA-SPECTROGRAPH FOR PHOTOGRAPHIC RECORDING OF CONVERSION LINES. Hilding Slätis. *Rev. Sci. Instr.* 24, 464-6(1953) June.

The design of a semicircular permanent-magnet β spectrograph for high resolution when investigating conversion lines in β spectra is discussed and illustrated with diagrams. Only sources are used in which the absorption of electrons in the sample itself does not limit the resolution. With ThB-activated tungsten wires, narrow baffles, and a constant temperature, a half width of some conversion lines equal to 1.2 parts in 10,000 was obtained. (L.M.T.)

4643

FOIL UNIFORMITY MEASUREMENTS BY ALPHA-PARTICLE TRANSMISSION. W. C. Barber. *Rev. Sci. Instr.* 24, 269-70(1953) June.

A method described for foil-uniformity measurement by α -particle transmission utilizes a source, collimator, foil and foil adjuster, and an end-window geiger counter. The apparatus is placed in air or other gas with the end-window

counter adjusted so that the amount of matter from source to sensitive region of the counter is slightly less than the range of the α particles. When the foil is moved so that the α 's traverse a slightly different thickness, a large change in counting rate is noted. Calibration is obtained by measuring the curve of counting rate as a function of thickness between source and counter. Results are shown for measurements on a Be foil of 1.472 mg/cm² mean thickness. (L.M.T.)

MESONS

4644

κ MESONS. J. Crussard, L. Leprince-Ringuet, D. Morellet, A. Orkin-Lecourtois, and J. Trembley. *Phys. Rev.* 90, 1127-9(1953) June 15.

Six κ mesons coming to rest in the emulsion were observed in a series of 600- μ Ilford G5 plates exposed to the cosmic radiation at balloon altitude. Most of the plates were exposed under a Cu absorber 3 cm thick. Among the κ mesons, three are ejected from stars; their ranges were sufficiently long (5000, 6000, and 9000 μ) to allow accurate measurements of their masses. Two of the three remaining mesons were observed in favorable conditions to give some indication of the nature of the secondary particles. (auth)

4645

UNUSUAL π - μ DECAYS IN PHOTOGRAPHIC EMULSIONS. W. F. Fry. *Phys. Rev.* 91, 130-4(1953) July 1. (cf. NSA 6-4177).

A total of 11,841 π - μ decays has been studied in Ilford C2 and G5 photographic plates, where both the π - and μ -meson tracks stopped in the emulsion. In 12 cases the range of the μ -meson track from the π -meson decay is less than 480 microns and in 2 cases the range is greater than 720 microns. The ranges of the μ -meson tracks of the 14 unusual π - μ decays are: 120, 185, 258, 260, 290, 416, 430, 441, 444, 470, 470, 476, 828, and 1035 microns. The normal range of the μ -meson from π -meson decays is about 600 microns. A study of the grain density in C2 plates, gap density in G5 plates, and the number and energy of the δ rays along the short μ -meson tracks indicates that the μ mesons were ejected from the π decays with a lower velocity than from normal π - μ decays. It is possible to explain the short range of the μ meson in 4 of the events and the long range of the μ meson in the 2 events by assuming that the π meson decayed in flight. The grain density or gap density along the μ - and π -meson tracks in the remaining 8 events is inconsistent with the assumption that the short range of the μ meson is due to the decay in flight of the π meson. If a correction is made for the thickness of the emulsion, the probability that a μ meson from a stopped π -meson decay will have a range less than 480 microns is found to be $3.3 \pm 1.3 \times 10^{-4}$. This probability is in general agreement with theoretical predictions based upon the assumption that a soft photon is occasionally emitted from the π - μ decay resulting from the charge acceleration of the μ meson. (auth)

MICROWAVES

4646

WAVE GUIDES WITH NONIDEAL WALLS. B. Z. Katzenelenbaum. Translated from *Doklady Akad. Nauk S.S.S.R.* 88, 37(1953). 4p. (NSF-tr-11; D-88-37)

The problem of the determination of the velocity, attenuation, and configuration of the field of electromagnetic waves in a waveguide of arbitrary cross section whose walls are good conductors is considered. Solution is obtained by a consistent expansion of the field into a power series of a

small quantity that represents the complex wave resistance of the material of the walls. (L.M.T.)

MOLECULAR PROPERTIES

4647

Illinois Inst. of Tech.

INVESTIGATION OF IMPERFECTIONS IN SOLIDS;
PROGRESS REPORT COVERING THE PERIOD JUNE 1952
TO FEBRUARY 1953. Theodore J. Neubert. Mar. 14,
1953. 39p. (COO-145)

Measurement of the internal friction and elastic modulus of cast polycrystalline specimens of Ag_2HgI_4 as a function of temperature exhibit a large hysteresis in the transition region 40 to 50°C and a serious dependence upon sample history. The similarity of the Ag_2HgI_4 system to the Cu_3Au system is confirmed by all data obtained so far. X rays induce coloration in NaCN crystals at room temperatures, but the crystals bleach rapidly in the dark. The one definite band observed is thought to be the F-band, and its lack of stability is ascribed to the thermal reorienting of cyanide ions. (J.S.R.)

NUCLEAR PHYSICS

4648

MASS SURFACES. Alex E. S. Green and Nicholas A. Engler. *Phys. Rev.* **91**, 40-5(1953) July 1.

Examination is made of smooth mass surfaces which may be placed in the form

$$M - A = \Delta_m(A) + J(A)[D - D_m(A)]^2,$$

Where $\Delta_m(A)$, $D_m(A)$, and $J(A)$ are key functions which characterize the mass surface and $D = N - Z$ is the neutron excess. Attempt is made to find an optimum set of key functions and to evaluate various semi-empirical key functions now in use. The following reference key functions are introduced:

$$\Delta_m(A) = (A - 100)^2/100 - 64, \text{ (mMU)}$$

$$J(A) = 25/A, \text{ (mMU)}$$

$$D_m(A) = 0.4A^2/(A + 200).$$

These reference functions are used in such a way as to effectively subject the data and various semi-empirical functions to microscopic examination, so that "fit" becomes immediately apparent. It is noted that most of the semi-empirical mass surfaces in current use give rise to large systematic errors in nuclear masses. The large errors are not inherent properties of the semi-empirical equation since a set of constants can be found which reduce these errors to within the range of uncertainty caused by shell effects. (auth)

4649

DISCONTINUITIES IN THE NUCLEAR MASS SURFACE. Alex E. S. Green and David F. Edwards. *Phys. Rev.* **91**, 46-53(1953) July 1.

Proton and neutron binding energies are analyzed in such a way as to permit an approximate assessment of the effects associated with pairing and shell structure. Several interesting conclusions are drawn with respect to the accuracy of various theoretical expressions which have been proposed for the pairing effect. Analysis of the data and considerations of an atomic model lead to a simple approximate representation of a shell-stabilizing correction to nuclear energies. This shell-structure term accounts rather well for the observed departures from the general trends of β stability, nuclear masses, and nuclear Q values. The shell correction suggests that much larger

systematic variations in nuclear masses may be identified with shell-structure effects than might previously have been suspected. (auth)

4650

NUCLEAR PHOTOSTAR PRODUCTION. Israel Reff. *Phys. Rev.* **91**, 150-5(1953) July 1.

Cross sections for photonuclear star production are computed phenomenologically for photomeson production in a nucleus followed by meson absorption in the same nucleus. Results are found for values of the mean free path of mesons in nuclear matter of 4×10^{-13} and 8×10^{-13} cm as a function of atomic mass number and photon energy. The process accounts for a large part of observed photostars with three and more prongs for elements as heavy as Br, but for only a small part for elements as light as O. (auth)

NUCLEAR PROPERTIES

4651

Oak Ridge National Lab.

SUPPLEMENTARY REMARKS ON ANGULAR CORRELATION. M. E. Rose. Issued July 1, 1953. 14p. (ORNL-1555)

Additional remarks are made pertaining to a previous report (Biedenharn and Rose, *Revs. Mod. Phys.* (1953) July) on the theory of angular correlation of nuclear radiations. This one is confined to three questions: (a) direction-direction correlation in which charged particles (notably, conversion electrons) are emitted, (b) polarization-direction correlations in $\gamma\text{-}\gamma$ cascades, and (c) $\gamma\text{-}\gamma$ cascades in which an intervening radiation is unobserved. (J.A.G.)

4652

THERMAL NEUTRON CAPTURE CROSS SECTION OF Na^{23} AND Mn^{55} . Rosalie M. Bartholomew, R. C. Hawkings, W. F. Merritt, and L. Yaffe. *Can. J. Chem.* **31**, 204-6 (1953) Mar.

The thermal-neutron capture cross sections of Na^{23} and Mn^{55} have been determined using the activation method. The values are 0.53 ± 0.03 and 12.7 ± 0.3 b, respectively, with respect to the cross section of Au^{197} of 93 b. These agree well with recent pile-oscillator results. The half life of Mn^{56} is found to be 2.576 ± 0.002 hr. (auth)

4653

THE SPIN AND MAGNETIC MOMENT OF Ca^{43} . C. D. Jeffries. *Phys. Rev.* **90**, 1130(1953) June 15.

The magnetic resonance of Ca^{43} was observed at a frequency of 2.85 Mc in a magnetic field of 10,000 gauss using a recording nuclear-induction spectrometer. The sample consisted of a 0.7M aqueous solution of CaBr_2 , enriched to 60% Ca^{43} , mixed with a 4.5M aqueous solution of MnCl_2 containing a few percent D_2O . The D_2O provided a deuteron magnetic resonance signal for reference and the Mn^{++} ions acted as a paramagnetic catalyst to shorten the relaxation time. From the measurements the spin of Ca^{43} was set as $\frac{7}{2}$, and a magnetic moment value of -1.3152 ± 0.0002 nm was determined. (L.M.T.)

4654

ENERGY LEVELS OF C^{12} FROM THE $\text{Be}^9(\alpha, n)\text{C}^{12}$ REACTION. L. E. Beghian, H. H. Halban, T. Husain, and L. G. Sanders. *Phys. Rev.* **90**, 1129(1953) June 15.

Energy levels of C^{12} were studied by examining the γ radiation from the reaction $\text{Be}^9(\alpha, n)\text{C}^{12}$. The α particles were emitted from a thin Po source deposited on a thin Pt foil. The foil was placed adjacent to a square of Be foil and the whole enclosed in an evacuated Cu box with sides 1 mm thick. The γ radiation was analyzed with a pair spectrometer and the spectrum displayed on a 25-channel kick-sorter. Gamma radiation of energy 3.16 ± 0.05 Mev and intensity $\sim 3\%$ was obtained in addition to the well-known

4.43-Mev line. However, in view of previous evidence obtained from internal pairs (Harries and Davies, *Proc. Phys. Soc. (London)* A65, 564(1952)) the level is suggested as 7.59 Mev rather than 3.16 Mev. Tests were made showing definitely that the radiation was not due to secondary effects of the neutrons. (L.M.T.)

4655

NEUTRON CAPTURE CROSS SECTION OF Em^{222} . A. P. Baerg. *Phys. Rev.* 90, 1121(1953) June 15.

Measurements were made of the cross section of Rn^{222} for slow neutron capture to form Rn^{223} which has not been previously reported. The Rn^{223} was expected to be a β emitter (half life ~ 5 min) and its daughter Fr^{223} is also a short-lived β emitter decaying to Ra^{223} , an α emitter with a half life of 11.2 day. The production of Rn^{223} and subsequently the capture cross section of Rn^{222} was measured by observing the growth of Ra^{223} . The cross section as measured by three experiments was found to be ~ 0.7 b. (L.M.T.)

4656

TOTAL NEUTRON CROSS SECTIONS OF CHLORINE AND CARBON. R. M. Kiehn, Clark Goodman, and K. F. Hansen. *Phys. Rev.* 91, 66-7(1953) July 1.

Using CCl_4 in good geometry, $\text{Li}^7(p,n)$ neutrons and pressurized hydrogen counter, $\sigma_t(\text{Cl})$ has been measured by the transmission method from 0.4 to 1 Mev at 30-kev intervals and from 0.15 to 0.75 Mev at 2-kev intervals. Corrections were made for the C in the CCl_4 after measurement of the total cross section of C, using graphite as a scatterer. (auth)

4657

THE CALCULATION OF THE HALF-WIDTHS OF ONE-BODY RESONANCES. John L. Johnson and J. L. McHale. *Phys. Rev.* 91, 87-9(1953) July 1.

Half widths of resonances for protons incident on a number of light nuclei with Z ranging between 4 and 14 are calculated in the one-body approximation. It is found that neglecting the tail of the wave function in the integral representing the probability of the proton being in the incident state can lead to errors of the order of 50%. Estimates of level shifts are also made using formulas derived by Breit. These represent approximately the difference between the energy at which the phase shift is 90° and the energies corresponding to maxima of the absolute value of the radial function \mathcal{R} or else of the absolute value of \mathcal{R}/G , where G is the irregular function. Both \mathcal{R} and G are normalized to unit amplitude at a large distance. (auth)

4658

NUCLEAR MAGNETIC RESONANCE IN THALLIUM COMPOUNDS. H. S. Gutowsky and B. R. McGarvey. *Phys. Rev.* 91, 81-6(1953) July 1.

A precision, resonance-absorption measurement has been made of the ratio of the magnetic moments of Tl^{205} and Tl^{203} . The experimental ratio is $\mu^{205}/\mu^{203} = 1.009838 \pm 0.000001$. This result, when compared with the value observed by Berman for the ratio of hyperfine structure separations in the $2^1P_{1/2}$ state, $\Delta\nu^{205}/\Delta\nu^{203} = 1.00974 \pm 0.00003$, establishes the reality of effects attributable to the finite nuclear size. Shifts of about 0.2% have been found in the Tl resonance position in Tl^{+3} compared to Tl^{+1} compounds. The resonance shifts in aqueous solutions varied linearly with the anion concentration. Complex formation and interionic electronic-exchange interactions, respectively, account qualitatively for the observed effect. (auth)

NUCLEAR REACTORS

4659

AUTOMATIC CONTROL CHARACTERISTICS OF THERMAL NEUTRON REACTORS. J. H. Bowen. *Proc. Inst.*

Elec. Engrs. (London) 100, Pt. I, 102-9(1953) May.

The influence of delayed neutrons on the automatic control of the power level of a thermal reactor is described. The frequency-response characteristic of a reactor is obtained theoretically and shown to be confirmed experimentally; from it is derived an empirical transfer function. It is shown that the observed response of the closed-sequence system controlling reactor power, following step changes in the desired power level, is in good agreement with the response calculated from the transfer function. Some practical uses of the analysis are indicated. (auth)

NUCLEAR TRANSFORMATION

4660

Livermore Research Lab., Calif. Research and Development Co.

THE EXCITATION FUNCTION FOR THE $\text{Al}^{27}(d,\alpha p)\text{Na}^{24}$ REACTION. R. E. Batzel, W. W. T. Crane, and G. D. O'Kelley. Jan. 15, 1953. 13p. (MTA-26)

The absolute cross section for the $\text{Al}^{27}(d,\alpha p)\text{Na}^{24}$ reaction has been measured as a function of deuteron energy from the threshold to 190 Mev. Targets were irradiated on the Berkeley 60-in. and 184-in. cyclotrons. The observed threshold is 11.0 ± 0.5 Mev; and the excitation function has a pronounced peak of 53 mb at approximately 22 Mev, falls to a broad minimum of 18 mb in the region of 60 Mev, and then rises slowly to 22 mb at 190 Mev. (auth)

4661

Livermore Research Lab., Calif. Research and Development Co.

CROSS SECTIONS FOR FORMATION OF Na^{22} FROM ALUMINUM AND MAGNESIUM BOMBARDED WITH PROTONS. R. E. Batzel and G. H. Coleman. Jan. 15, 1953. 11p. (MTA-27)

Cross sections for formation of Na^{22} from proton bombardment of Al and Mg have been determined for the energy range from thresholds to 32 Mev. The $\text{Al}^{27}(p,\alpha n)\text{Na}^{22}$ reaction has a threshold of 25 Mev and the cross section for the reaction rises to a value of 2.5 mb at 32 Mev. The cross section for the production of Na^{22} from Mg has a value of 0.25 mb at 10 Mev, rises through a maximum of 9 mb at 17 Mev, drops to a minimum of 5 mb at 23 Mev, and then rises to a value of 19 mb at 32 Mev. (auth)

4662

CONSEQUENCES OF CHARGE INDEPENDENCE FOR NUCLEAR REACTIONS INVOLVING PHOTONS. Murray Gell-Mann and Valentine L. Telegdi. *Phys. Rev.* 91, 169-74(1953) July 1.

Some effects of the charge independence of nuclear forces on the emission and absorption of photons by light nuclei are investigated. It is found that the selection rules governing the change of isotopic spin, T, in such transitions are of practical importance in nuclei with $T_z = 0$, particularly the rule that E1 transitions without change of isotopic spin are forbidden. Two examples of forbidden E1-emission (in N^{14} and O^{16}) are discussed, and detailed experimental reinvestigation is suggested in connection with each of them. The main consequence for photonuclear reactions of the aforementioned selection rule is that for each $T_z = 0$ nucleus there is a threshold for (allowed) E1 absorption, corresponding to the first level with $J = 1^-$, $T = 1$. For (γ,α) and (γ,d) reactions, where no isotopic spin can be carried off by the particle, E1 absorption can become effective only when there is enough energy to leave the residual nucleus in a $T = 1$ state. The roles of E2 and M1 absorption, with and without change of isotopic spin, are discussed, and appropriate sum rules are derived. The rules governing (γ,α) processes are applied particularly to reactions in C^{12} and O^{16} , where considerable experi-

mental evidence is available and appears to support the theoretical conclusions. (auth)

4663

PHOTOPROTONS FROM Mo^{100} AND Mo^{92} . W. A. Butler and G. M. Almy. *Phys. Rev.* **91**, 58-65(1953) July 1.

The absolute yield and the energy and angular distributions of protons emitted from targets of concentrated isotopes Mo^{92} and Mo^{100} , under betatron x radiation of maximum energy 22.5 Mev, have been determined with nuclear emulsions as detector of protons. For Mo^{92} the proton is less tightly bound than the neutron by 5.0 Mev; for Mo^{100} the proton is more tightly bound by 2.4 Mev. Comparison of the large yield and the energy distribution of protons from Mo^{92} with those calculated from the statistical model shows good agreement except for an observed excess of high-energy protons, which are also anisotropic. They are presumably due to a direct-emission process with which neutron emission does not compete in the normal way. With Mo^{100} , however, the yield, though 20 times smaller, exceeds the yield predicted on the statistical model by 20 to 125 times depending upon the processes and parameters assumed in the calculation. Most of the protons, therefore, must come from a direct process. The observed energy distribution is similar to one computed using the experimental (γ, p) cross section if it is assumed that the residual nucleus is left with a typical exponential energy-level-density distribution. The angular distribution is strongly anisotropic with a maximum near 45° for protons of energy greater than 5 Mev. (auth)

4664

THE FISSION YIELD OF I^{131} IN THE THERMAL NEUTRON FISSION OF U^{235} . Rosalie M. Bartholomew, F. Brown, R. C. Hawkings, W. F. Merritt, and L. Yaffe. *Can. J. Chem.* **31**, 120-5(1953) Feb.

The fission yield of I^{131} has been investigated using improved extraction techniques and disintegration-rate measurements. The value obtained for the fission yield is $3.1 \pm 0.1\%$. This is relative to a Ba^{140} reference fission yield of 6.1%. The half life for I^{131} was found as 8.05 ± 0.01 days. (auth)

4665

OBSERVATION OF V^0 PARTICLES PRODUCED AT THE COSMOTRON. W. B. Fowler, R. P. Shutt, A. M. Thorndike, and W. L. Whittemore. *Phys. Rev.* **90**, 1126-7(1953) June 15.

Two definite examples of V^0 particles similar to those found in cosmic rays by many workers have been observed in a cloud chamber exposed to a neutron beam from the Brookhaven Cosmotron. These two cases, in addition to several other less definite ones, were found in a total of about 4000 photographs scanned up to date. The details of the events are presented. (auth)

4666

THE INDEPENDENT YIELD OF Xe^{135} PRODUCED IN THE FISSION OF NATURAL URANIUM BY PILE NEUTRONS. F. Brown and L. Yaffe. *Can. J. Chem.* **31**, 242-9(1953) Mar.

Fission of U yields Xe^{135} by two routes: direct production and production by the β decay of I^{135} . The amount produced directly (independent yield) has been measured by comparison with the amount produced from I^{135} . The independent fission yield of Xe^{135} is found to be $2.7 \pm 1.0\%$ of the cumulative yield of I^{135} . Assuming this latter quantity to be 5.6% of all fissions, the independent yield of Xe^{135} is $\sim 0.15\%$. The half life of Xe^{135} has been measured to be 9.13 ± 0.05 hr. (auth)

PARTICLE ACCELERATORS

4667

Microwave Lab., Stanford Univ.
A HIGH ENERGY LINEAR ELECTRON ACCELERATOR.

Richard B. Neal. Feb. 1953. 403p. (ML-185)

The design, construction, and early tests of the 1-bev linear electron accelerator being constructed at Stanford are reported. The following topics are included: discussion of accelerators and general description of the Mark III; manufacture of the Mark III sub-sections; effect of constructional errors, frequency deviations, and temperature variations; the vacuum system and field and secondary emission; generation of r-f power; the r-f transmission components; the electron injection problem; initial bunching of electrons; magnetic shielding of the accelerator; target-end equipment and techniques; and preliminary operational results. The appendix contains a discussion of a single-feed accelerator with constant axial field strength. (L.T.W.)

4668

Radiation Lab., Univ. of Calif., Berkeley
ALTERNATING GRADIENT FOCUSING OF THE 20-INCH CYCLOTRON EXTERNAL BEAM. Edward L. Hubbard and Elmer L. Kelly. Apr. 23, 1953. 23p. (UCRL-2181)

The 0.75-Mev external proton beam from the 20-in. cyclotron appeared to diverge from an astigmatic source. With a series of 3 alternately converging and diverging electrostatic lenses of hyperbolic cross section, it was possible either to focus the external beam to a spot or to make it parallel. (auth)

4669

ENERGY SPECTRUM MEASUREMENTS OF PROTONS IN THE HARWELL CYCLOTRON. J. M. Dickson and D. C. Salter. *Brit. J. Appl. Phys.* **4**, 175-6(1953) June.

The proton spectrum of the Harwell cyclotron has been measured by a method which uses the cyclotron magnet as a momentum analyser. For a maximum energy of 174 Mev, the width of the spectrum at half height was of the order of 10 Mev. Random variations of the spectrum shape were observed which were thought to depend on the ion source. A systematic variation of spectrum width with r-f accelerating voltage was found. (auth)

4670

LONG X-RAY PULSES FROM THE BETATRON. T. J. Keegan. *Rev. Sci. Instr.* **24**, 472(1953) June.

It has been found practical to lengthen the x-ray pulse duration from the 22-Mev betatron at the Univ. of Illinois considerably by simply moving the orbit to the target slowly by means of a long, slowly rising, orbit-displacing flux. By increasing the amount of capacitance and inductance in the usual expander circuit, x-ray pulses 30 to 40 μsec long were obtained at all energies. For example, by increasing the capacitance by a factor of 8 and adding 170- μh inductance in series with the expander coils, an x-ray pulse of 40- μsec duration at 21.5 Mev was obtained. A new expander circuit for the purpose of further lengthening the expander pulse to approximately 800 μsec is described. (auth)

RADIATION ABSORPTION AND SCATTERING

4671

Rochester Univ.
DOUBLE SCATTERING OF HIGH ENERGY PROTONS BY HYDROGEN AND CARBON. C. L. Oxley, W. F. Cartwright, J. Rouvina, E. Baskir, D. Klein, J. Ring, and W. Skillman. June 15, 1953. 4p. (NYO-3824)

Measurements have been made of the asymmetry in the second scattering of protons first scattered from an internal target in the 240-Mev beam of the cyclotron. With a first target of C and an effective H second target, the asymmetry was found to be $20.6 \pm 2.2\%$. With a polyethylene first target, $50 \pm 5\%$ of the protons accepted in the second scattering were from the H in the first target. The asymmetry in this case was $15.2 \pm 2.2\%$. From these values the asymmetry in double p-p scattering was calculated to be $9.8 \pm 5\%$. The asymmetry in double scattering from C targets was found

to be $49.5 \pm 8\%$. The asymmetry in this case for double p-p scattering was $8.5 \pm 2.2\%$. (L.T.W.)

4672

ANGULAR DISTRIBUTION OF PIONS SCATTERED BY HYDROGEN. H. L. Anderson, E. Fermi, R. Martin, and D. E. Nagle. *Phys. Rev.* **91**, 155-68(1953) July 1. (cf. NSA 6-4606).

The angular distribution of pions scattered by liquid H has been studied using the collimated pion beams from the Chicago synchrocyclotron. Differential cross sections have been measured for the laboratory angles 45° , 90° , and 135° for positive pions of energies 78 Mev, 110 Mev, and 135 Mev, and for negative pions of 120 Mev and 144 Mev. For negative ions, separate results were obtained for the elastic scattering and for the charge-exchange scattering. The scattering of positive pions and charge-exchange scattering of negative pions show a larger intensity in the backward direction. The elastic scattering of negative pions is mostly forward. The results have been interpreted in terms of phase-shift analysis on the assumption that the scattering is mainly due to states of isotopic spins $\frac{3}{2}$ and $\frac{1}{2}$ and angular momenta $s_{\frac{1}{2}}$, $p_{\frac{1}{2}}$, and $p_{\frac{3}{2}}$. The experimental results are represented quite accurately by the following phase shifts expressed in degrees for the angular momentum states in the order indicated above: at 120 Mev, phase shifts ∓ 15 , ± 4 , ± 30 for isotopic spin $\frac{3}{2}$ and ± 9 , ∓ 3 , ± 2 for isotopic spin $\frac{1}{2}$; at 135 Mev, ∓ 14 , ± 5 , ± 38 for isotopic spin $\frac{3}{2}$ and ± 10 , ∓ 5 , ± 2 for isotopic spin $\frac{1}{2}$. (auth)

4673

THE SCATTERING OF SLOW NEUTRONS BY ORTHO- AND PARA-HYDROGEN. A. T. Stewart and G. L. Squires. *Phys. Rev.* **90**, 1125(1953) June 15.

The slow-neutron scattering cross sections of ortho- and para- H_2 were reinvestigated in order to determine the triplet and singlet scattering amplitudes of the neutron-proton interaction. The attenuation of a beam of slow neutrons (energies 0.002 to 0.014 ev) passing through a specimen of H_2 gas was measured by moving the specimen in and out of the beam. Measurements were first made on normal H_2 , 75% ortho and 25% para, and secondly with specimens of 99.8% para, the equilibrium mixture at $20.4^\circ K$. Careful determinations were made of the ortho-para composition of the specimens. Results give a value of $-3.80 \pm 0.05 \times 10^{-13}$ cm for f , the coherent scattering amplitude, and a value of $20.41 \pm 0.14 \times 10^{-24}$ cm² for σ_f , the free proton cross section. (L.M.T.)

4674

THE INTERACTION OF 14-MEV NEUTRONS WITH PROTONS AND DEUTERONS. J. C. Allred, A. H. Armstrong, and L. Rosen. *Phys. Rev.* **91**, 90-9(1953) July 1.

Nuclear emulsions in conjunction with a neutron collimator have been used to measure the differential cross section as a function of angle for the elastic scattering of monoenergetic 14-Mev neutrons by protons and by deuterons. Measurements were carried out in the angular regions corresponding to neutrons being scattered at angles between 48 and 154.5° in the c.m. system by protons and between 46 and 176° in the same coordinate system by deuterons. The n-p scattering data are consistent with isotropic scattering in the c.m. system, and are in excellent agreement with the data of Barschall and Taschek. The n-d elastic scattering data are strongly anisotropic. The shape of the angular distribution of the neutrons elastically scattered by deuterons may be inferred from the differential cross sections in mb for the following laboratory angles: 2° , 435 ± 28 ; 10° , 342 ± 27 ; 20° , 78 ± 9.3 ; 30° , 38 ± 4.2 ; 40° , 59 ± 5.2 ; 50° , 104 ± 9.0 ; 60° , 136 ± 12 ; 65° , 142 ± 14 . Strong evidence for the reaction $D(n,2n)H$

has been found and an attempt to determine the energy and angular distribution of the disintegration protons was moderately successful. (auth)

4675

A DIFFUSION CLOUD-CHAMBER STUDY OF PION INTERACTIONS IN HYDROGEN AND HELIUM. E. C. Fowler, W. B. Fowler, R. P. Shutt, A. M. Thorndike, and W. L. Whittemore. *Phys. Rev.* **91**, 135-49(1953) July 1.

A description is given of the operation of a high-pressure diffusion cloud chamber filled with H or He and exposed to pion beams of both signs and energies near 60 and 100 Mev. Interactions occurring in the gas filling are investigated. The cross sections found in H agree with the results of others, including the large difference between the cross sections for positive and negative mesons. In He the total cross sections are 89 ± 18 and 207 ± 27 mb with beams at 60 and 105 Mev, respectively. These cross sections include elastic and inelastic scattering, charge exchange, and absorption. The charge-exchange cross sections, estimated at 20 and 60 mb for the two respective energies, are much larger than observed by others for different nuclei. Assuming that the mesons interact with the individual nucleons in the nucleus, an approximate calculation shows that a fairly consistent picture can be obtained making use of phase shifts determined by Anderson et al., for meson scattering on hydrogen. (auth)

RADIATION EFFECTS

4676

Atomic Energy Research Establishment, Harwell, Berks (England)

THE COLOURATION OF SOME OPTICAL GLASSES BY X AND GAMMA RADIATION. J. V. F. Best. Mar. 10, 1953. 20p. (AERE-C/R-1125)

Samples of optical and other glasses have been subjected to large doses of x and γ rays and their resistance to coloration studied. Optical glasses are more prone to coloration than plate glass and the borosilicate compositions used for chemical glassware. Perspex, polystyrene, and two European glasses containing small amounts of Ce are very resistant to coloration. A brief summary of recent American experience in this field is appended. (auth)

4677

Research Foundation, Washington Univ., Clayton, Mo. THE EFFECT OF CHARGED PARTICLES ON THE PHYSICO-MECHANICAL PROPERTIES OF MATERIALS; MONTHLY REPORT COVERING THE PERIOD AUGUST 15, 1950 TO SEPTEMBER 15, 1950. W. P. Armstrong. 17p. (NEPA-1579; NEPA-IY-8)

4678

Research Foundation, Washington Univ., Clayton, Mo. THE EFFECT OF CHARGED PARTICLES IN THE PHYSICO-MECHANICAL PROPERTIES OF MATERIALS; MONTHLY REPORT COVERING THE PERIOD NOVEMBER 15, 1950 TO DECEMBER 15, 1950. W. P. Armstrong. 14p. (NEPA-1674; NEPA-IY-11)

4679

BEHAVIOR OF TWO TYPES OF THERMOCOUPLES UNDER PILE IRRADIATION AT LOW TEMPERATURES. R. E. Jamison and T. H. Blewitt. *Rev. Sci. Instr.* **24**, 474(1953) June.

Both Cu-constantan and Fe-constantan thermocouples were tested in groups of three each in a liquid-N₂ bath placed in the Oak Ridge X pile. The test ran for 60 hours, giving a net integrated fast flux of 5×10^{16} nvt. The emf, corrected to constant pressure of the liquid N₂, remained constant ± 0.01 mv throughout the test. The warm junction being at ice temperature, the emf of the three Cu-con-

stantan couples averaged 5.43 mv, while those of the three Fe-constantan couples averaged 7.72 mv. It should be noted that failure of the lacquered glass insulation on the thermocouples caused grounding to the Al Dewar, invalidating readings from the Fe-constantan couples during the last 8 hours and making readings from the Cu-constantan couples intermittent during the last 3 hours of testing. (auth)

RADIOACTIVITY

4680

Radiation Lab., Univ. of Calif., Berkeley

THE COMPLEX ALPHA SPECTRA OF THE HEAVY ELEMENTS (thesis). Francesco Asaro. June 1953. 167p. (UCRL-2180)

Using a 75-cm-radius 60° symmetrical electromagnetic analyzer, the complexity of the α spectra of $\text{Cm}^{244,243,242}$, $\text{Am}^{243,241}$, $\text{Pu}^{242,241,240,239,238}$, $\text{U}^{234,233,232,230}$, $\text{Th}^{228,226}$, $\text{Ra}^{226,224,223,222}$, $\text{Rn}^{212,211,210,208}$, $\text{At}^{211,210}$ and $\text{Po}^{211,209,208}$ was investigated. The γ rays of $\text{Cm}^{243,242}$, Am^{243} , Pu^{238} , U^{234} , Th^{228} and Rn^{211} were also studied. Decay schemes have been proposed for many of the nuclides and empirical correlations have been determined for the energies and intensities of the α groups observed in the even-even nuclei. These correlations have been evaluated with respect to α -decay theory and recent developments in the literature. (auth)

4681

Radiation Lab., Univ. of Calif., Berkeley

THE ALPHA SPECTRA OF Cm^{242} , Cm^{243} , AND Cm^{244} .

Frank Asaro, S. G. Thompson, and I. Perlman. Apr. 23, 1953. 33p. (UCRL-2193)

The α and γ spectra of Cm^{242} , Cm^{243} , and Cm^{244} have been studied with an alpha particle spectrograph and γ -ray scintillation counters. Cm^{242} has α groups of 6.110 (73.7%), 6.066 (26.3%), and 5.964 Mev (0.035%) and γ rays of 44 (0.041%), 100 (0.006%), and 157 kev (0.0027%). Cm^{243} has α groups of 5.985 (6%), 5.777 (81%), and 5.732 Mev (13%) and γ rays of 104, 226, and 278 kev in coincidence with the 5.777-Mev α group. Cm^{244} has α groups of 5.798 (75%) and 5.755 Mev (25%). The spectra are discussed relative to α decay theory and corresponding excited states reached by β^- decay processes. (auth)

4682

GALLIUM-64. Bernard L. Cohen. *Phys. Rev.* **91**, 74-5 (1953) July 1.

A new isotope, 2.5-min Ga^{64} , was produced by the (p,n) reaction on Zn^{64} and identified by measurement of the excitation function, by bombardment of separated isotopes, and by chemical separation. Its decay scheme includes gammas of 0.97 Mev, 3.8 Mev, and probably 2.2 Mev. The maximum energy of the principle beta is about 5 Mev. The threshold for Zn^{64} (p,n) is 8.1 ± 0.5 Mev. (auth)

4683

THE NEUTRON ACTIVATION OF Ca^{46} . L. G. Cook and K. D. Shafer. *Phys. Rev.* **90**, 1121(1953) June 15.

The decay of Ca^{47} in neutron-irradiated Ca was observed indirectly by noting the decrease in yield of Sc^{47} on successive milkings. The irradiated Ca was spiked with Sc^{46} tracer, and the Sc fraction was removed, purified by thenoyltrifluoroacetone-benzene extraction and ion exchange on Dowex-50, and estimated. This was repeated at weekly intervals for eight weeks. The decrease in yield of Sc^{47} gave a half life for Ca^{47} of 4.8 ± 0.5 days. (auth)

4684

SPONTANEOUS FISSION OF URANIUM. Hoff Lu and Hsuan-Ling Tsao. *Acta Sci. Sinica* **1**, 77-84(1952) Oct.

An attempt has been made to determine the half life for spontaneous fission for the average U atom with an A-filled parallel-plate ionization chamber, employing the method of electron collection. A simple method of ana-

lyzing and extrapolating the observed fission counts from U deposits of various thicknesses has yielded the value $4.2 \pm 0.6 \times 10^{16}$ yr for the half life and ~ 7.5 mg/cm² U for the mean range of fission fragments in U oxide. (auth)

4685

SEARCH FOR 1-MEV GAMMA FROM N^{16} DECAY. F. Boehm, D. C. Peaslee, and V. Perez-Mendez. *Phys. Rev.* **90**, 1119-20(1953) June 15.

Previous measurements on the β decay of N^{16} reveal a discrepancy between a branching ratio of $\sim 1:1$ determined from absorption measurements on the β spectrum and the ratio of $\sim 1:12$ from measurement of the associated γ -ray intensities. As a check on the problem a search was made for a strong 1-Mev γ ray following N^{16} decay. The reaction $\text{O}^{16}(\text{n,p})\text{N}^{16}$ was used to produce N^{16} in a cyclotron, using fast neutrons from $\text{Be}(\text{d,n})$ on a H_2O target. A 10-sec bombardment produced a very strong activity with the characteristic N^{16} half life of 7 sec. After waiting 5 sec for decay of shorter activities, the γ activity was measured with a scintillation counter consisting of a 1-in. NaI crystal. A strong line was found at 6 Mev and in a weak exposure a 0.5 Mev peak was visible due to annihilation of positrons formed outside the crystal. No γ line was found between these. An upper intensity limit, $I(1 \text{ Mev})/I(6 \text{ Mev}) \leq 0.05$ was established. To account for the previously mentioned discrepancy the ratio would have to be at least 10 times larger. (L.M.T.)

4686

MATRIX ELEMENTS OF β -DECAY IN jj COUPLING. Igal Talmi. *Phys. Rev.* **91**, 122-5(1953) July 1.

Matrix elements of various allowed β transitions are calculated in the jj coupling scheme. It is found that for Gamow-Teller matrix elements there is no distinction between favored and unfavored transitions, which appears to be in contrast with the experimental facts. (auth)

4687

NUCLEAR LEVELS IN Cs^{131} . J. M. Cork, J. M. LeBlanc, W. H. Nester, and M. K. Brice. *Phys. Rev.* **91**, 76-7(1953) July 1.

Using enriched Ba^{130} , activated in the pile, a spectrometric study has been made of the radiation from the resultant Ba^{131} . Decaying by K capture with a half life of 11.8 days, thirteen γ -rays are found to be associated with the disintegration, eight of which have not been previously reported. From the relative intensities of the electron lines and the photoelectron peaks, the multipolarities of six of the transitions are given. A consistent nuclear level scheme of seven terms accounts completely for the observed γ transitions. (auth)

4688

CALORIMETRIC DETERMINATION OF THE HALF-LIFE OF POLONIUM. D. C. Ginnings, Anne F. Ball, and D. T. Vier. *J. Research Natl. Bur. Standards* **50**, 75-9(1953) Feb.

The heats of radioactivity of four samples of Po have been measured with a Bunsen ice calorimeter over a period of about 7 months. With samples ranging in initial powers from 0.17 to 1.4 watts, the half-life values calculated from these measurements were found to agree within 0.1%, or the equivalent of 0.0003 watt, whichever was the larger. The results with the sample with the largest power gave a half-life value of 138.39 days, with an uncertainty of 0.1% (0.14 day). This is in agreement with the value of 138.3 days ($\pm 0.1\%$) reported by Beamer and Easton, who used a different calorimetric method. (auth)

4689

THE β -DECAY OF Li^8 . D. StP. Bunbury. *Phys. Rev.* **90**, 1121-2(1953) June 15.

The β decay of Li^8 was studied by observing the angular correlation between the decay electrons and α particles

from the subsequent break-up of Be^8 . A β spectrometer was used to select electrons from the high-energy part of the spectrum, and the α particles were detected with a thin-window proportional counter which could be rotated about the source. The Li^8 was produced by 530-kev deuteron bombardment of natural Li. The spectrometer resolution was set at $\sim 7\%$, and the coil currents were set to select electrons of 9.8 and 7.5 Mev, corresponding to 0.8 and 0.6 of the end-point energy of the β spectrum, respectively. Measurements were made at five angles from 90 to 175° , and the results were fitted by least squares to the expression $(1 + A \cos^2 \theta)$. The values of A found in the two cases were, respectively, 0.04 ± 0.2 and 0.12 ± 0.09 , which agree with the measurements of Class and Hanna (Phys. Rev. **89**, 877(1953)). In the course of the experiment, the half life of Li^8 was remeasured as 0.89 ± 0.01 sec. (L.M.T.)

4690

THE O^{14} β -DECAY AND THE FERMI INTERACTION.

M. E. Rose. Phys. Rev. **90**, 1123-4(1953) June 15.

In O^{14} β decay, it has been suggested that the γ recoil can be taken into account by observing triple coincidences between the photon, positron, and recoil N^{14} . However, in view of experimental difficulties, the γ recoil is taken into consideration here by a direct calculation. The nuclear recoil momentum is $P = -(p + q + k) = -(Q + k)$, where p , q , and k are the momenta of the positron, neutrino, and photon, respectively. Since the photon is isotropic with respect to p and q , the distribution $N(P)dp$ of recoils with momentum between P and $P + dP$ is obtained essentially by integrating the spectrum of β recoils (distribution in Q) over the appropriate Q limits. The analytic form of the result depends upon whether or not $k > Q_{\max} = (W_0^2 - 1)^{1/2}$. However, the shape of the spectrum changes continuously throughout this point. Results give values of $k = 4.52$ and $Q_{\max} = 4.41$ (corresponding to 1.8 Mev for the maximum β energy). The recoil-momentum spectrum is shown for this case and for pure scalar, vector, and tensor interactions. (L.M.T.)

SHIELDING

4691

Radiation Physics Lab., National Bureau of Standards
OBLIQUE ATTENUATION OF GAMMA-RAYS FROM COBALT-60 AND CESIUM-137 IN POLYETHYLENE, CONCRETE AND LEAD. Frederick S. Kirn, Robert J. Kennedy, and H. O. Wyckoff. Dec. 23, 1952. 19p. (NBS-2125)

Radiation attenuation in polyethylene, concrete; and lead, used in the design of radiation shielding, was studied at various γ -ray energies. (J.E.D.)

SPECTROSCOPY

4692

Spectroscopy Lab., Ill. Inst. of Tech.
SUBSTITUTED METHANES. 15. INFRARED SPECTRAL DATA, ASSIGNMENTS, AND CALCULATED THERMODYNAMIC PROPERTIES FOR FLUOROTRICHLOROMETHANE; TECHNICAL REPORT ON MOLECULAR SPECTROSCOPY, MOLECULAR STRUCTURE AND THERMODYNAMICS. James P. Zietlow, Forrest F. Cleveland, and Richard B. Bernstein. Submitted Jan. 28, 1953. 12p. (NP-4360; Technical Report 11)

Infrared spectral data for gaseous CCl_3F have been obtained in the region 400 to 3200 cm^{-1} , using both NaCl and KBr prisms. The present data are compared with previous Raman and infrared data, and assignments and calculated wave numbers are given. The fundamentals for the gas are: $\nu_1(a_1)$ 1085, $\nu_2(a_1)$ 534, $\nu_3(a_1)$ 354, $\nu_4(e)$ 846, $\nu_5(e)$ 398, and $\nu_6(e)$ 245 cm^{-1} . Thermodynamic properties were calculated with the usual assumptions for 12 temperatures from 100 to

1000°K. The calculated values are compared with previous calorimetric results. (auth)

4693

Spectroscopy Lab., Ill. Inst. of Tech.
SUBSTITUTED METHANES. 17. VIBRATIONAL SPECTRA, POTENTIAL CONSTANTS, AND CALCULATED THERMODYNAMIC PROPERTIES OF DIODOMETHANE; TECHNICAL REPORT ON MOLECULAR SPECTROSCOPY, MOLECULAR STRUCTURE AND THERMODYNAMICS. Fred L. Voelz, Forrest F. Cleveland, Arnold G. Meister, and Richard B. Bernstein. Submitted May 28, 1953. 16p. (NP-4622; Technical Report 13)

Raman displacements, semiquantitative relative intensities, quantitative depolarization factors, and wave numbers for the infrared bands in the region 400 to 3800 cm^{-1} have been obtained for liquid CH_2I_2 . A normal coordinate treatment was carried out, and a reasonable set of potential constants was determined, using the most general quadratic potential-energy function. Assignments were made for all observed Raman and infrared bands. The heat content, free energy, entropy, and heat capacity at constant pressure were calculated for 12 temperatures from 100 to 1000°K. (auth)

THEORETICAL PHYSICS

4694

Argonne National Lab.
APPROXIMATE HARTREE TYPE WAVE FUNCTIONS AND MATRIX ELEMENTS FOR THE K AND L SHELLS OF ATOMS AND IONS. R. E. Meyerott. Mar. 1953. 40p. (ANL-5008)

The straightforward procedure of obtaining Hartree wave functions for a sample of states of each atom for each stage of ionization and computing the proper matrix elements is a prohibitively long program even for high-speed computers. Since the quantities involved are nearly hydrogen-like, it is probable that the same amount of information can be obtained with considerably less work. Two possibilities suggest themselves to limit the amount of work involved in this computation: (1) carry out the calculation for, say, every tenth atom throughout the periodic table for a variety of stages of ionization, instead of for every atom; (2) calculate effects of screening as an explicit function of the atomic number and the state of ionization. This paper presents a description of the second type of calculation and a discussion of the validity of the method. (auth)

4695

THEORY OF THE PERIODIC SYSTEM OF THE ELEMENTS. D. Ivanenko and S. Larin. Translated from Doklady Akad. Nauk S.S.S.R. **88**, 45(1953). 4p. (NSF-tr-2; D-88-45)

It is thought that the error in the theoretical values of Z_1 obtained by means of the original Thomas-Fermi model results from a failure of the model to allow for the exchange interaction of the electrons. Therefore, the approximate Thomas-Fermi-Dirac equation, which takes into account the effect of exchange, is used here to elaborate the usual approximate theory of the Mendeleev periodic system. (L.M.T.)

4696

OBSERVATIONS ON NONLINEAR MESON DYNAMICS. D. Ivanenko, D. Kurdgelaidze, and S. Larin. Translated from Doklady Akad. Nauk S.S.S.R. **88**, 245(1953). 3p. (NSF-tr-4; D-88-245)

The nonlinear equation of a real scalar meson field in the presence of sources, obtained from phenomenological field theory using quasi-dielectric permeabilities, is solved for special cases, and it is concluded that interactions transmitted by a nonlinear field weaken over small distances. (L.T.W.)

4697

ON SPECTROSCOPIC DETERMINATION OF THE QUADRUPOLE MOMENTS OF NUCLEI. I. I. Goldman. Translated from *Doklady Akad. Nauk S.S.S.R.* 88, 241(1953). 3p. (NSF-tr-5; D-88-241)

The present theory of hyperfine structure takes into account the interaction between the nuclear moments and the single electron undergoing an optical transition, but does not take into account the effect of screening (the deformation of the inner electron shells by the optical electron). This note presents a calculation of this effect using the Thomas-Fermi approximation. The results indicate that the real nuclear quadrupole moments, when the screening factor is taken into account, are larger than those generally accepted in the literature. (L.M.T.)

4698

NONCENTRAL FORCE MATRIX ELEMENTS FOR THE NUCLEAR d^2 CONFIGURATION. L. W. Longdon. *Phys. Rev.* 90, 1125-6(1953) June 15.

A study of the tensor-operator algebra of Racah led to the derivation of expressions for the matrix elements, between two-nucleon states, of the purely orbital operators of the two-body tensor and spin-orbit interaction operators. The Slater method of expanding the distance dependence was used, and the results obtained involve linear combinations of radial integrals in which no particular wave functions or interactions are specified. (auth)

4699

EXCHANGE SCATTERING IN A THREE-BODY PROBLEM. Harry E. Moses. *Phys. Rev.* 91, 185-92(1953) July 1.

It is proved that in the three-body scattering problem, the prototype of which is the scattering of an electron by a H atom, the coefficient corresponding to exchange scattering behaves like a radially outgoing wave. The essential conjecture used by Mott and Massey in their treatment of the problem is thus verified. (auth)

URANIUM AND URANIUM COMPOUNDS

4700

Atomic Energy Research Establishment, Harwell, Berks (England)

A METHOD OF DETERMINING ISOTOPIC COMPOSITION OF URANIUM SAMPLES. J. Derham and F. W. Fenning. Mar. 24, 1953. 9p. (AERE-R/R-1149)

This method consists of a simple comparison of β activity of a known amount of the sample with the β activity of a similar sample of natural U. If the samples are pure compounds of U, the β activities will be due to Th^{234} , Pa^{234} , and Th^{231} . The maximum energies of Th^{234} and Th^{231} are both ~ 0.2 Mev, so that from a thick source with suitable absorber the main β activity observed is due to Pa^{234} . This β activity is proportional to the amount of U^{238} present in the source. From a comparison of β activities the U^{238} content of the enriched sample is deduced, while, since U^{234} is short-lived compared to the other isotopes, α -activity measurements give the U^{234} content. The specimens are purified by extracting $\text{UO}_2(\text{NO}_3)_2$ from aqueous solution with ethyl ether. (Revised version of AERE-R/R-834) (auth)

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For each reference the digit preceding the dash is the volume number and digits after the dash are the abstract number.

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